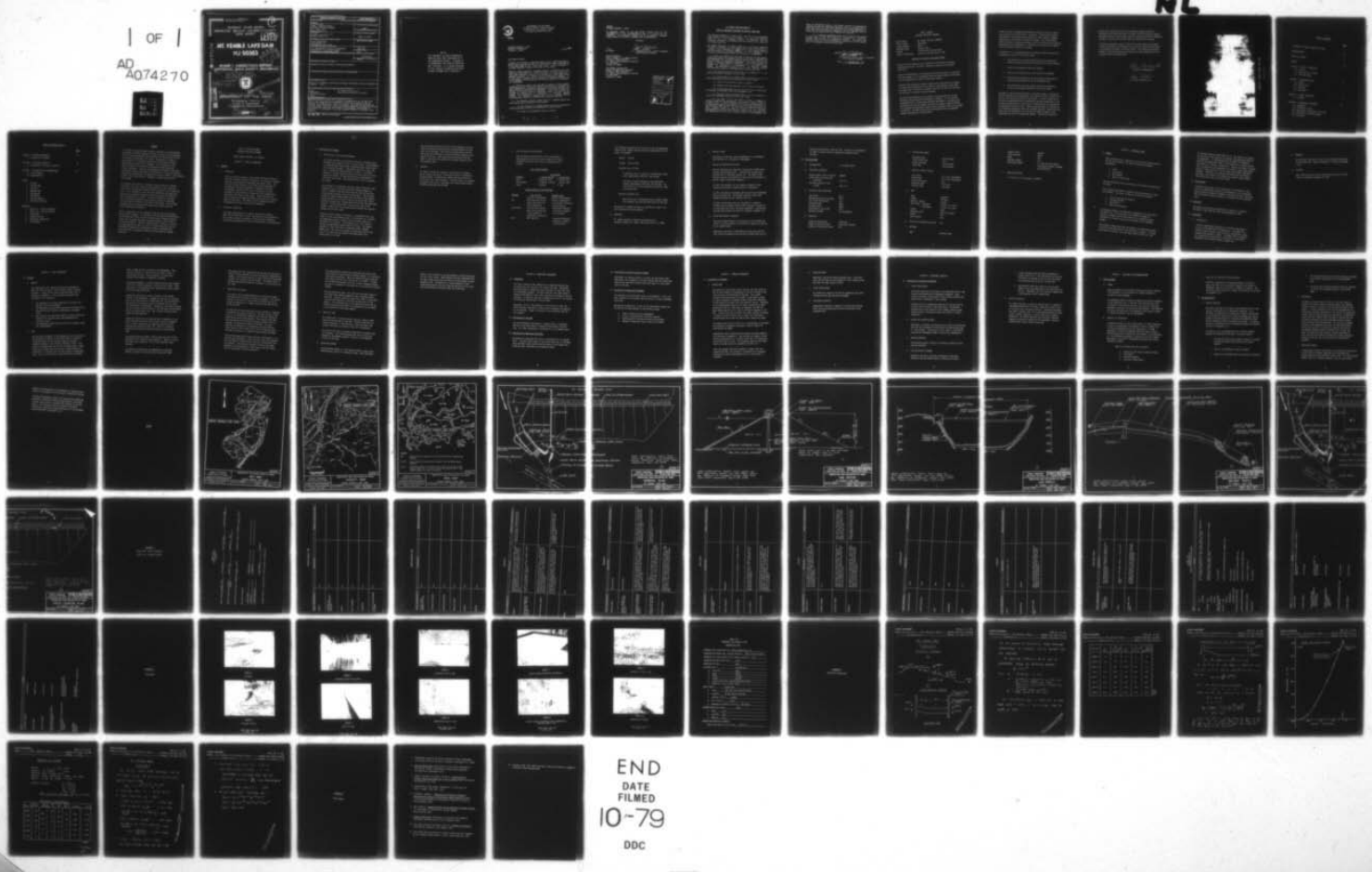
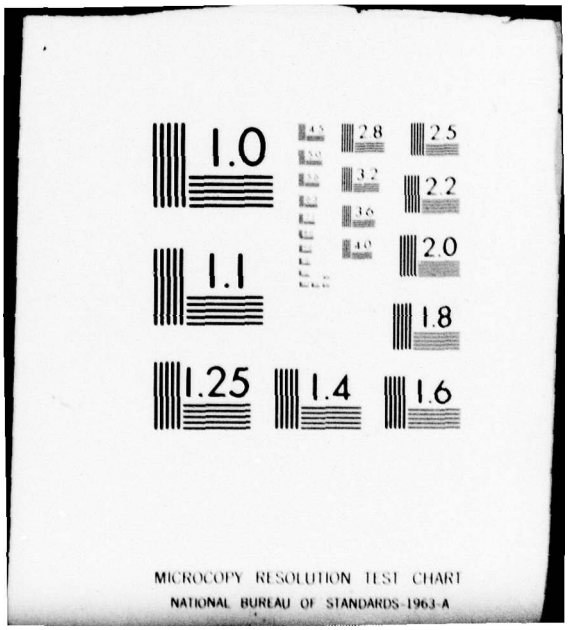
AD-A074 270 NEW JERSEY DEPT OF ENVIRONMENTAL PROTECTION TRENTON F/G 13/2
NATIONAL DAM SAFETY PROGRAM. MT. KEMBLE LAKE DAM. (NJ-00363). P--ETC(U)
JUL 79 R J MCDERMOTT, J E GRIBBIN DACW61-79-C-0011

UNCLASSIFIED NL

| OF |
AD A074270



END
DATE FILMED
10-79
DDC


1.0
1.1
1.25
1.4
1.6
2.8
3.2
3.6
4.0
2.5
2.2
2.0
1.8
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

PASSAIC RIVER BASIN
PRIMROSE BROOK - MORRIS COUNTY
NEW JERSEY

LEVEL II

MT. KEMBLE LAKE DAM
NJ 00363

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Mt. Kemble Lake Dam. (NJ-00363).
Passaic River Basin. Primrose Brook-
Morris County, New Jersey. Phase 1
Inspection Report.

(9) Final rept.,

(10) Richard J. /McDermott John E. /Gribbin

(15) DACW61-79-C-0011

DEPARTMENT OF THE ARMY
Philadelphia District
Corps of Engineers
Philadelphia, Pennsylvania

(12) 87p.

(11) Jul[redacted]79

410 891

SECURITY CLASSIFICATION OF THIS PAGE (When Date Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER NJ00363	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Phase I Inspection Report National Dam Safety Program M.T. Kemble Lake Morris County, N.J.		5. TYPE OF REPORT & PERIOD COVERED FINAL 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) McDermott, Richard J. P.E. Gribbin, John E. P.E.		8. CONTRACT OR GRANT NUMBER(s) DACW61-79-C-0011
9. PERFORMING ORGANIZATION NAME AND ADDRESS Storch Engineering 220 Ridgedale Ave. Florham Park, N.J. 07932		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Engineer District, Philadelphia Custom House, 2d & Chestnut Streets Philadelphia, Pennsylvania 19106		12. REPORT DATE July 1979 13. NUMBER OF PAGES 60
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) Unclassified 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

Copies are obtainable from National Technical Information Service, Springfield, Virginia, 22151.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Dams
Embankments
Structural Analysis
Safety
Visual Inspection
Mt. Kemble Lake Dam, N.J.
National Dam Inspection Act Report

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report cites results of a technical investigation as to the dam's adequacy. The inspection and evaluation of the dam is as prescribed by the National Dam Inspection Act, Public Law 92-367. The technical investigation includes visual inspection, review of available design and construction records, and preliminary structural and hydraulic and hydrologic calculations, as applicable. An assessment of the dam's general condition is included in the report.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

SECURITY CLASSIFICATION OF THIS PAGE (When Date Entered)

DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
CUSTOM HOUSE—2D & CHESTNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

IN REPLY REFER TO
NAPEN-D

Honorable Brendan T. Byrne
Governor of New Jersey
Trenton, NJ 08621

17 SEP 1979

Dear Governor Byrne:

Inclosed is the Phase I Inspection Report for Mt. Kemble Lake Dam in Morris County, New Jersey which has been prepared under authorization of the Dam Inspection Act, Public Law 92-367. A brief assessment of the dam's condition is given in the front of the report.

Based on visual inspection, available records, calculations and past operational performance, Mt. Kemble Lake Dam, initially listed as a high hazard potential structure, but reduced to a significant hazard potential structure, as a result of this inspection, is judged to be in fair overall condition and the spillway is considered adequate. To insure adequacy of the structure, the following actions, as a minimum, are recommended:

a. Within six months from the date of approval of this report, engineering studies and analyses should be performed to determine the dam's embankment and foundation condition and structural stability and develop a plan for regrading the embankment. This should include test borings to determine material properties relative to stability and seepage and installation of piezometers to facilitate seepage studies. The embankment regrading and any other remedial measures found necessary, should be initiated within calendar year 1980.

b. The following remedial actions should be completed within one year from the date of approval of this report:

(1) The spillway and discharge channel should be renovated by pressure grouting, patching and coating with an epoxy sealant.

(2) Trees on the embankment should be removed.

NAPEN-D
- Honorable Brendan T. Byrne

An important aspect of the Dam Safety Program will be the implementation of the recommendations made as a result of the inspection. We accordingly request that we be advised of proposed actions taken by the State to implement our recommendations.

Sincerely,

JOEL T. CALLAHAN
Lieutenant Colonel, Corps of Engineers
Acting District Engineer

1 Incl
As stated

Copies furnished:
Dirk C. Hofman, P.E., Deputy Director
Division of Water Resources
N.J. Dept. of Environmental Protection
P.O. Box CN029
Trenton, NJ 08625

John O'Dowd, Acting Chief
Bureau of Flood Plain Management
Division of Water Resources
N.J. Dept. of Environmental Protection
P.O. Box CN029
Trenton, NJ 08625

MT. KEMBLE LAKE DAM (NJ00363)

CORPS OF ENGINEERS ASSESSMENT OF GENERAL CONDITIONS

This dam was inspected on 24 April and 1 June 1979 by Storch Engineers under contract to the State of New Jersey. The State, under agreement with the U.S. Army Engineer District, Philadelphia, had this inspection performed in accordance with the National Dam Inspection Act, Public Law 92-367.

Mt. Kemble Lake Dam, initially listed as a high hazard potential structure, but reduced to a significant hazard potential structure, as a result of this inspection, is judged to be in fair overall condition and the spillway is considered adequate. To insure adequacy of the structure, the following actions, as a minimum, are recommended:

a. Within six months from the date of approval of this report, engineering studies and analyses should be performed to determine the dam's embankment and foundation condition and structural stability and develop a plan for regrading the embankment. This should include test borings to determine material properties relative to stability and seepage and installation of piezometers to facilitate seepage studies. The embankment regrading and any other remedial measures found necessary, should be initiated within calendar year 1980.

b. The following remedial actions should be completed within one year from the date of approval of this report:

(1) The spillway and discharge channel should be renovated by pressure grouting, patching and coating with an epoxy sealant.

(2) Trees on the embankment should be removed.

(3) Riprap on the upstream face of dam should be renovated.

(4) The drainage ditch east of the dam should be redirected to eliminate concentrated flow on the embankment face.

(5) The outlet works discharge channel should be renovated to relieve the submerged condition of the outlet pipes.

(6) The owner of the dam should initiate a program of periodic inspection and maintenance, the complete records of which to be kept on file. A visual inspection of the dam and appurtenances by a professional engineer experienced in the design and construction of dams should be made annually and reported on a standarized check-list form. Repairs should be made as required and the following maintenance should be performed annually: remove trees and brush from the embankment, fill and sod any eroded surfaces of the embankment and

clear the downstream channel. The current practice of periodically lowering the lake for maintenance purposes should be continued and at least once every five years the lake should be lowered completely at which time the lake should be cleaned and normally submerged portions of the dam and spillway should be inspected and repaired.

(7) A detailed topographic survey of the dam and area around the dam based on USGS datum should be undertaken by a qualified licensed land surveyor or professional engineer. The survey map should be related to existing construction drawings and should become part of the permanent record mentioned above.

APPROVED: Joel T. Callahan

JOEL T. CALLAHAN
Lieutenant Colonel, Corps of Engineers
Acting District Engineer

DATE: 13 September 79

PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam:	Mt. Kemble Lake Dam, NJ00363
State Located:	New Jersey
County Located:	Morris
Drainage Basin:	Passaic River
Stream:	Tributary to Primrose Brook
Dates of Inspection:	April 24, 1979 and June 1, 1979

Assessment of General Condition of Dam

Based on visual inspection, past operational performance and Phase I engineering analyses, the dam is assessed as being in fair overall condition.

Based on investigations of the downstream flood plain made in connection with this report, it is recommended that the hazard potential classification be downgraded from high to significant hazard.

Hydraulic and hydrologic analyses indicate that the spillway is capable of passing the designated spillway design flood (100-year storm) when the water level in the lake is equal to the crest of dam and, therefore, the spillway is assessed as being adequate.

Variations were observed in the slope of the downstream face of dam indicating the possibility of embankment sloughing. It is therefore recommended that a professional engineer experienced in the design and construction of dams be engaged very soon to prepare a detailed design for regrading the embankment slopes and the embankment should be regraded accordingly. The design should be coordinated with the recommended seepage investigation outlined below.

Extensive areas of seepage were observed at and near the toe of dam in the vicinity of the outlet works. Therefore, a professional engineer experienced in the design and construction of dams should be engaged immediately to investigate the observed seepage. The investigation should include all necessary measures, such as: dye testing, borings and measurements with piezometers, to determine the effect of the seepage on the structural integrity of the dam.

In addition, it is recommended that the following remedial measures be undertaken by the owner in the near future:

1. The spillway and discharge channel should be renovated by pressure grouting, patching and coating with an epoxy sealant.

2. Trees on the embankment should be removed.

3. Riprap on the upstream face of dam should be renovated.

4. The drainage ditch east of the dam should be redirected to eliminate concentrated flow on the embankment face.

5. The outlet works discharge channel should be renovated to relieve the submerged condition of the outlet pipes.

The owner of the dam should initiate, in the near future, a program of periodic inspection and maintenance, the complete records of which to be kept on file and made available to the public. A visual inspection of the dam and appurtenances by a professional engineer experienced in the design and construction of dams should be made annually and reported on a standardized check-list form. Repairs should be made as required and the following maintenance should be performed annually: remove trees and brush from the embankment, fill and sod any eroded surfaces of the embankment and clear the downstream channel. The current practice of

periodically lowering the lake for maintenance purposes should be continued and at least once every five years the lake should be lowered completely at which time the lake should be cleaned and normally submerged portions of the dam and spillway should be inspected and repaired.

A detailed topographic survey of the dam and area around the dam based on USGS datum should be undertaken by a qualified licensed land surveyor or professional engineer in the near future. The survey map should be related to existing construction drawings and should become part of the permanent record mentioned above.

Richard J. McDermott

Richard J. McDermott,P.E.

John E. Gribbin

John E. Gribbin, P.E.

OVERVIEW - MOUNT KEMBLE LAKE DAM

24 APRIL 1979

TABLE OF CONTENTS

	Page
ASSESSMENT OF GENERAL CONDITION OF DAM	i
OVERVIEW PHOTO	iv
TABLE OF CONTENTS	v
PREFACE	vii
SECTION 1 - PROJECT INFORMATION	1
1.1 General	
1.2 Description of Project	
1.3 Pertinent Data	
SECTION 2 - ENGINEERING DATA	10
2.1 Design	
2.2 Construction	
2.3 Operation	
2.4 Evaluation	
SECTION 3 - VISUAL INSPECTION	13
3.1 Findings	
SECTION 4 - OPERATIONAL PROCEDURES	18
4.1 Procedures	
4.2 Maintenance of Dam	
4.3 Maintenance of Operating Facilities	
4.4 Description of Warning System	
4.5 Evaluation	

TABLE OF CONTENTS (cont.)

	Page
SECTION 5 - HYDRAULIC/HYDROLOGIC	20
5.1 Evaluation of Features	
SECTION 6 - STRUCTURAL STABILITY	22
6.1 Evaluation of Structural Stability	
SECTION 7 - ASSESSMENT AND RECOMMENDATIONS	24
7.1 Dam Assessment	
7.2 Recommendations	

PLATES

1 KEY MAP
2 VICINITY MAP
3 SOIL MAP
4 GENERAL PLAN
5 DAM SECTION
6 DAM PROFILE
7 SPILLWAY PROFILE
8 PHOTO LOCATION PLAN

APPENDICES

1 Check List - Visual Inspection
Check List - Engineering Data
2 Photographs
3 Engineering Data
4 Hydrologic Computations
5 Bibliography

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 30214. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. It is important to note that the condition of dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that the unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

MOUNT KEMBLE LAKE DAM, I.D. NJ00363

SECTION 1: PROJECT INFORMATION

1.1 General

a. Authority

Public Law 92-367, August 8, 1972 authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The Division of Water Resources of the New Jersey Department of Environmental Protection (NJDEP) in cooperation with the Philadelphia District of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the State of New Jersey. Storch Engineers has been retained by the NJDEP to inspect and report on a selected group of these dams. The NJDEP is under agreement with the Philadelphia District of the Corps of Engineers.

b. Purpose of Inspection

The visual inspections of Mt. Kemble Lake Dam were made on April 24, 1979 and June 1, 1979. The purpose of the inspections was to make a general assessment of the structural integrity and operational adequacy of the dam structure and its appurtenances.

1.2 Description of Project

a. Description of Dam and Appurtenances

Mt. Kemble Lake Dam is an earthfill dam with a concrete chute spillway and a gated twin cast iron pipe outlet. The embankment is formed between steep slopes of exposed basalt bedrock which act as natural abutments. Reportedly, the area in which the dam is located was formerly used as a quarry. A concrete corewall is located along the center of the dam for its entire length and extends 1.8 feet above the top of embankment to form the crest of dam. The upstream face of dam is protected by riprap.

The spillway is a reinforced concrete, broad crested weir that discharges into a reinforced concrete discharge channel or chute. Located at the west end of the dam, the spillway weir is constructed between concrete training walls. The concrete discharge channel extends downstream from the spillway approximately one-half the distance to the toe of dam at which point discharge cascades over exposed bedrock and enters the downstream channel. A stone masonry wall forms the east side of the channel in the area of the exposed bedrock between the concrete channel and the toe of dam.

Having an overall length of 285 feet, the embankment has a top width of 8 feet and upstream slope of 2 horizontal to 1 vertical. The downstream slope is variable with an overall slope of 2 horizontal to 1 vertical. The spillway has a crest length of 40 feet and downstream channel width of 13 feet. The channel gradient is 0.127 ft/ft and is constructed with a stepped bottom slab. The vertical distance from spillway crest to dam crest is 3.3 feet and the height of dam (measured at the outlet works) is 36 feet.

The outlet works consists of twin 12-inch diameter cast iron pipes transversely penetrating the dam approximately 35 feet east of the spillway. Two manually operated gates, one for each pipe, are contained in a concrete manhole located at the center of the dam. Steel operating stems extend from the gates to the top of the manhole and protrude through a cast iron manhole cover.

b. Location

Mt. Kemble Lake Dam is located in the Township of Harding, Morris County, New Jersey. Constructed across a tributary to Primrose Brook, it impounds Mt. Kemble Lake which forms the focal point for a lake community. Principal access is provided by Bayley's Mill Road, a secondary road located approximately 250 feet downstream from the dam.

c. Size and Hazard Classification

Size and Hazard Classification criteria presented in "Recommended Guidelines for Safety Inspection of Dams", published by the U.S. Army Corps of Engineers are as follows:

SIZE CLASSIFICATION

	Impoundment	
Category	Storage (Ac-ft)	Height (Ft)
Small	< 1000 and ≥ 50	< 40 and ≥ 25
Intermediate	≥ 1000 and $< 50,000$	≥ 40 and < 100
Large	$\geq 50,000$	≥ 100

HAZARD POTENTIAL CLASSIFICATION

Category	Loss of Life (Extent of Development)	Economic Loss (Extent of Development)
Low	None expected (no permanent structures for human habitation)	Minimal (Undeveloped to occasional structures or agriculture)
Significant	Few (No urban developments and no more than a small number of inhabitable structures)	Appreciable (Notable agriculture, industry or structures)
High	More than few	Excessive (Extensive community, industry or agriculture)

The following characteristics relating to size and downstream hazard for Mt. Kemble Lake Dam have been determined for this Phase I assessment:

Height: 36 feet

Storage: 163 acre-feet

Potential Loss of Life:

A secondary road is located in the downstream flood plain approximately 250 feet from the dam.

One home is located adjacent to the downstream channel approximately 2100 feet from the dam. The first floor is 10.5 feet (measured vertically) above the channel bed.

Potential Economic Loss:

Dam failure due to overtopping would probably damage the secondary road 250 feet downstream from the dam.

Therefore, Mt. Kemble Lake Dam is classified as "small" size and "significant" hazard potential.

d. Ownership

Mt. Kemble Lake Dam is owned and operated by the Lakeshore Company, Mt. Kemble Lake, Morristown, N.J. 07960.

e. Purpose of Dam

The purpose of the dam is the impoundment of a recreational lake facility for a residential development.

f. Design and Construction History

The dam reportedly was originally constructed in 1928 with a 20-foot long spillway crest. Construction drawings were prepared by W.H. Boardman, Newark, N.J. The owner of the original dam was the Lakeshore Co. which was the developer of the Mt. Kemble residential community.

In 1951, the Lakeshore Co. was bought by members of the community and became a property owners' corporation.

In 1971, the dam was overtopped and the east end of embankment partially washed out. The washout caused no significant damage downstream and was repaired with fill.

In 1976, the spillway crest was enlarged to a length of 40 feet and the concrete corewall was increased in height to 1.8 feet above the top of the earth embankment. Construction drawings were prepared by Osborne M. Campbell, Mendham, N.J.

g. Normal Operational Procedures

The dam and appurtenances are maintained by the Lakeshore Co. There is no fixed schedule of maintenance; repairs are made on an "as needed" basis.

Reportedly, the lake is drawn down once every two years for lake related maintenance and the gate is opened every year to

evacuate settled debris from the lake. The gate is not operated at times of severe storms to augment the capacity of the spillway.

1.3 Pertinent Data

a.	Drainage Area	0.73 square miles
b.	Discharge at Damsite	
	Maximum known flood at damsite	Unknown
	Outlet works at normal pool elevation	30 c.f.s.
	Spillway capacity at top of dam	610 c.f.s.
c.	Elevation (Feet above MSL)	
	Top of Dam	291.7
	Maximum pool-design surcharge	291.7
	Full flood control pool	N.A.
	Recreation pool	288.5
	Spillway crest	288.4
	Stream bed at toe of dam	256±
	Maximum tailwater	261 (Estimated)
d.	Reservoir	
	Length of maximum pool	2,560 feet
	Length of recreation pool	2,400 feet (scaled)
	Length of flood control pool	N.A.

e. Storage (Acre-feet)

Recreation pool	118 acre-feet
Flood control pool	N.A.
Design surcharge	163 acre-feet
Top of dam	163 acre-feet

f. Reservoir Surface (Acres)

Top of dam	15.3 acres (Estimated)
Maximum pool	15.3 acres (Estimated)
Flood control pool	N.A.
Recreation pool	12.9 acres
Spillway crest	12.9 acres

g. Dam

Type	Earthfill
Length	285 feet
Hydraulic height	36 feet
Side slopes - Upstream	2 horiz. to 1 vert.
- Downstream	2 horiz. to 1 vert.
Zoning	None
Impervious core	Concrete corewall
Cutoff	N.A.
Grout curtain	N.A.

h. Diversion and Regulating Tunnel — N.A.

i. Spillway

Type	Concrete chute

Length of weir	40 feet
Crest elevation	288.4
Gates	N.A.
Upstream channel	N.A.
Downstream channel	13' wide concrete channel (rectangular section, stepped bottom profile)

j. Regulating Outlets

2 - 12" dia C.I.P. with gates in manhole.

SECTION 2: ENGINEERING DATA

2.1 Design

Plans prepared by W.H. Boardman for the original construction of the dam are available. The plans include the following information:

1. Plan
2. Dam Profile
3. Dam Section
4. Detail of Outlet Box.

No other engineering data pertaining to the original dam design are available.

Plans prepared by Osborne M. Campbell for the alterations in 1976 are available. The plans include the following information:

1. Plan of Spillway and Corewall
2. Spillway Profile
3. Dam Profile
4. Details and Sections

In addition, hydraulic and hydrologic computations are available in the NJDEP file. Also available is an Engineer's Report by Osborne M. Campbell and the description of an inspection report contained in a letter written by the president of the Lakeshore Company.

The Engineer's Report describes the hydraulic and hydrologic design criteria for the alterations to the spillway as follows: 1) design storm equal to 100-year storm with peak runoff of 500 c.f.s. and

2) spillway discharge coefficient of 3.4. The report also contains a discussion of the slopes of the upstream and downstream faces of the embankment. It acknowledges that the NJDEP had requested upstream and downstream slopes of 2 horizontal to 1 vertical and 2½ horizontal to 1 vertical, respectively. However, the report concludes that a regrading of the embankment to conform to those slopes would require a large amount of fill and would create other undesirable problems. Therefore, the necessary freeboard would be achieved, according to the report, by extending the corewall upward rather than raising the crest of dam by filling.

2.2 Construction

Information pertaining to the construction of alterations in 1976 consists of photographs taken by the Lakeshore Co. and a completion report prepared by Osborne M Campbell, dated May 25, 1976, certifying that the project had been completed in accordance with the approved plans.

2.3 Operation

Information pertaining to the operation of the dam is limited to one permit to draw down the lake issued September 3, 1971.

2.4 Evaluation

a. Availability

Available engineering information is limited to that which is on file at the NJDEP and the Lakeshore Co. The NJDEP file contains copies of plans, specifications, calculations, correspondence and engineer's report. The NJDEP file is available for inspection at the offices of the Bureau of Flood Plain Management, 1474 Prospect Street, Trenton, N.J.

b. Adequacy

The available information forms a fairly complete description of the subject dam. Absent information is listed in paragraph 7.1.b.

c. Validity

Most information that could be verified was found to be valid within a reasonable allowance for error.

SECTION 3: VISUAL INSPECTION

3.1 Findings

a. General

The inspections of Mt. Kemble Lake Dam were performed on April 24, 1979 and June 1, 1979 by staff members of Storch Engineers. A copy of the visual inspection check list is contained in Appendix I. The following procedures were employed for the inspection:

1. The embankment of the dam, appurtenant structures and adjacent areas were examined.
2. The embankment and accessible appurtenant structures were measured and key elevations determined by surveyor's level.
3. Key elevations of downstream channel, typical section and elevations of adjacent areas were determined by a surveyor's level.
4. The embankment, appurtenant structures and adjacent areas were photographed.

b. Dam

The horizontal alignment of the embankment varies from that of the construction drawings to the extent that it contains a slight bend while the construction drawings indicate a straight alignment. The vertical alignment is level. The slope of the downstream face of dam is steeper than 1.7 horizontal to 1 vertical near the top and is approximately 2.6 horizontal to 1 vertical for the lower portion of embankment face. Also, in the vicinity of the outlet works discharge

pipe, a steep section is present in the embankment. This section, which has a vertical extent of about 4 feet, is located near the toe. These variations in slope could indicate the presence of embankment sloughing.

The entire embankment is heavily wooded with pine and hardwood trees with a surface composed of typical forest litter. Some pine trees on the downstream face reportedly have been planted to provide slope protection.

Seepage was observed in various locations in the western portion of the embankment. Seepage was manifest as saturated soil in the steep section of embankment near the toe described earlier and as a large wet area at and beyond the toe along the western half of embankment. Seepage was also noted discharging as a trickle from two points in the bank above the discharge end of the outlet works pipe. One of these discharge points contains orange deposits.

Riprap was observed on the upstream face of embankment at its eastern end and consisted of well placed stones of adequate size. Similar riprap was also observed along the entire upstream face below the water line. Riprap is sparse or absent on the center and western portions of the upstream face.

The exposed concrete corewall located along the crest of dam appeared to be in generally good condition. However, vertical hairline cracks, spaced at 15 to 20 foot intervals, were observed.

No evidence of cracking of the embankment was observed. However, evidence of possible animal burrows was noted.

The generalized soil description for the dam site consists of recent alluvium composed of stratified materials deposited by streams. The alluvium overlies a heavy textured colluvium and residual soil overlying basalt bedrock. The Ramapo fault is located approximately 2500 feet northwest of, and parallel to, the lake.

c. Appurtenant Structures

The crest of the spillway appeared to be uniformly aligned horizontally but irregular in vertical alignment. The western portion of the crest is level while the eastern portion is sloped and generally at a higher elevation than that of the western portion.

The concrete slab that forms the crest of spillway is composed of separate east and west sections. The east section of the crest is in satisfactory condition while the west section is deteriorated and has been patched. The concrete slabs that form the bottom of the spillway discharge channel are also composed of separate east and west sections. The east sections are generally in satisfactory condition with one large cavity or spall noted at the time of inspection while the west sections are in a generally deteriorated condition.

The concrete comprising the east and west training walls is in generally good condition. Three vertical cracks were observed near the point of intersection of the east training wall and the corewall. One crack was observed in each of the three branches of the intersection. These cracks could be indications of settlement of the training wall.

The stone masonry training wall along the east side of the lower section of the spillway discharge channel is in generally satisfactory condition. Water was observed flowing along the east side of the wall for a portion of its length. It could not be determined whether this flow is due to seepage through the dam or to leakage of discharge out of the spillway discharge channel.

The gate operating stems, cast iron cover and metal steps of the outlet works manhole appeared to be in generally good condition. However, vertical cracks with widths of one-eighth inch each were observed in the east and west walls of the manhole. The discharge ends of the outlet pipes could not be clearly observed because they were submerged by the tailwater of the outlet works discharge channel.

d. Reservoir Area

Mt. Kemble Lake is long and narrow, having a length of 2400 feet and average width of 235 feet. Lakeside homesites are located along most of the shoreline. Docks and other lake related structures are present at many of the homesites.

The shore of the lake is generally steep with an average slope of 25 percent. The land surrounding the lake is hilly and wooded with development generally limited to the immediate vicinity of the lake.

e. Downstream Channel

The downstream channel is a well defined natural stream with a cobbled bottom typical of a mountain stream. Rocks and minor

debris in the vicinity of the dam comprise a slight obstruction to flow in the stream. Approximately 250 feet downstream from the dam, stream flow enters two 48-inch culverts under a paved secondary road. One dwelling is located adjacent to the stream approximately 2100 feet from the dam with a first floor 10½ feet (measured vertically) above the stream bed.

SECTION 4: OPERATIONAL PROCEDURES

4.1 Procedures

The level of water in Mt. Kemble Lake is regulated naturally by discharge over the spillway of Mt. Kemble Lake Dam. Reportedly, the outlet gate is opened once every two years to lower the lake for maintenance purposes. On these occasions, the water level is lowered approximately 6 feet, which requires an estimated 2 days to complete. In addition, the gate is opened each year for the purpose of evacuating settled debris from the lake.

Reportedly, prior to the widening of the spillway in 1976, the outlet gate was used during intense storms to augment the capacity of the spillway. However, the outlet is not presently used for this purpose.

4.2 Maintenance of the Dam

The only maintenance performed on a regular basis is the yearly opening of the outlet gate to evacuate settled debris from the lake. All other maintenance is performed on an "as needed" basis.

4.3 Maintenance of Operating Facilities

Maintenance of operating facilities is performed on an "as needed" basis. The most recent repair to the outlet works was in 1971 when rocks and debris were removed from the bottom of the manhole and extensions were installed on the operating stems.

4.4 Description of Warning System in Effect

Reportedly, no warning system is in effect at the present time. Reportedly, the occupants of the home located 2100 feet downstream from the dam have been informed that their home is in the flood plain of the dam.

4.5 Evaluation of Operational Adequacy

The operation of the spillway, since its enlargement in 1976, has been successful to the extent that the dam has not been overtopped since then.

Maintenance documentation is poor and the maintenance program for the dam has not been adequate in the following areas:

1. Trees allowed to grow on embankment.
2. Riprap on upstream face of dam not repaired.
3. Deterioration of spillway concrete not corrected.
4. Seepage on downstream side of dam not corrected.

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design Data

The quantity of storm water runoff that the spillway should be able to pass without an overtopping of the dam is based on the size and hazard classification of the dam. This runoff, called the spillway design flood (SDF) is described in terms of return frequency or probable maximum flood (PMF) depending on the extent of the dam's size and potential hazard. According to the "Recommended Guidelines for Safety Inspection of Dams" published by the U.S. Army Corps of Engineers, the SDF for Mount Kemble Dam falls in a range of 100-year frequency to 1/2 PMF. In this case, the low end of the range, 100-year frequency, is chosen since the factors used to select size and hazard classification are on the low side of their respective ranges.

The 100-year peak flood is 569 c.f.s. as calculated in accordance with analytical procedures contained in Special Report 38 published by the NJDEP.

Computations used to determine the spillway discharge capacity are contained in Appendix 4. The spillway was assumed to have outflow characteristics of a broad crested weir with discharge coefficient equal to 2.63. The discharge capacity (with water level at the dam crest) was computed to be 610 c.f.s.

Since the computed spillway discharge is greater than the computed SDF peak, the spillway is considered to be adequate according to criteria developed by the U.S. Army Corps of Engineers.

b. Experience Data

Reportedly, the dam has been overtopped once. Since that time, the spillway has been doubled in crest length and the dam crest has been raised 1.8 feet.

c. Visual Observations

No evidence was found at the time of inspection that would indicate that the dam had been overtopped.

d. Overtopping Potential

Computations outlined in Appendix 4 indicate that the dam would not be overtopped during storms equivalent to the designated SDF.

SECTION 6: STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

Variations observed in the slope of the downstream face of dam indicate the possibility of embankment sloughing. Also, cracks in the east training wall of the spillway indicate the possibility of settlement of the spillway.

Extensive areas of seepage were observed at and near the toe of dam in the vicinity of the outlet works. An accurate determination of the severity of the seepage cannot be made without further investigation beyond the scope of a Phase I inspection.

b. Design and Constuction Data

Reportedly, a one-half inch wide vertical crack in the concrete core wall was discovered in 1976 during the modification work on the spillway. The presence of this crack is confirmed by construction photographs taken in 1976 by the Lakeshore Co.

c. Operating Records

No operating records relating to structural stability of the dam are available.

d. Post Construction Changes

Changes to the dam or the area surrounding it that have occurred since the modifications in 1976 are as follows:

1. A storm drainage ditch has been constructed to channel runoff from a road located east of the dam. The runoff is directed so that it will flow along the downstream face of dam at its east end.

2. Approximately 1000 cubic yards of silt has been dumped in the area downstream of the east portion of the dam. Reportedly, the silt had been dredged from a lake upstream from Mt. Kemble Lake.

e. Seismic Stability

Mt. Kemble Lake Dam is located in Seismic Zone 1 as defined in "Recommended Guidelines for Safety Inspection of Dams" which is a zone of very low seismic activity. Experience indicates that dams in Seismic Zone 1 will have adequate stability under seismic loading conditions if stable under static loading conditions. Mt. Kemble Lake Dam, which exhibits extensive seepage and possible sloughing of its embankment, could be unstable under seismic loading conditions.

SECTION 7: ASSESSMENT AND RECOMMENDATIONS

7.1 Dam Assessment

a. Safety

Based on hydraulic and hydrologic analyses outlined in Section 5 and Appendix 4, the spillway of Mt. Kemble Lake Dam is assessed as being adequate.

The embankment exhibits extensive seepage and possible sloughing on the downstream face. A one-half inch wide vertical crack is present in the concrete wore wall and vertical cracks were observed in the walls of the outlet works manhole. The condition of the dam indicates that the embankment could become unstable if corrective measures are not implemented.

b. Adequacy of Information

Information sources for this study include: 1) field inspection, 2) plans, correspondence and engineer's report in NJDEP file, 3) plans and photographs from the Lakeshore Co., 4) USGS quadrangle, 5) aerial photography supplied by Morris County Planning Board and 6) consultation with members of the Lakeshore Co. The information obtained is sufficient to allow a Phase I assessment as outlined in "Recommended Guidelines for Safety Inspection of Dams."

Some of the absent data are as follows:

1. Stream and Lake elevation gaging records
2. Soil Report
3. Inspection Reports
4. Structural Design Report

c. Necessity for Additional Data/Evaluation

Additional evaluation is considered necessary in order to assess the effect of the observed seepage and variations in embankment slope on the structural integrity of the dam. The evaluation should be based on seepage investigations as outlined in paragraph 7.2.c.

7.2 Recommendations

a. Remedial Measures

Variations observed in the slope of the downstream face of dam indicate the possibility of embankment sloughing. It is therefore recommended that a professional engineer experienced in the design and construction of dams be engaged very soon to prepare a detailed design for regrading the embankment slopes and the embankment should be regraded accordingly. The design should be coordinated with the recommended seepage investigation outlined in paragraph 7.2.c.

In addition, it is recommended that the following remedial measures be undertaken by the owner in the near future:

1. The spillway and discharge channel should be renovated by pressure grouting and coating with an epoxy sealant.

2. Trees on the embankment should be removed.

3. Riprap on the upstream face of dam should be renovated.

4. The drainage ditch east of the dam should be redirected to eliminate concentrated flow on the embankment face.

5. The outlet works discharge channel should be renovated to relieve the submerged condition of the outlet pipes.

b. Maintenance

The owner of the dam should initiate, in the near future, a program of periodic inspection and maintenance, the complete records of which to be kept on file and made available to the public. A visual inspection of the dam and appurtenances by a professional engineer experienced in the design and construction of dams should be made annually and reported on a standardized check-list form. Repairs should be made as required and the following maintenance should be performed annually: remove trees and brush from the embankment, fill and sod any eroded surfaces of the embankment and clear the downstream channel. The current practice of periodically lowering the lake for maintenance purposes should be continued and at least once every five years the lake should be lowered completely at which time the lake should be cleaned and normally submerged portions of the dam and spillway should be inspected and repaired.

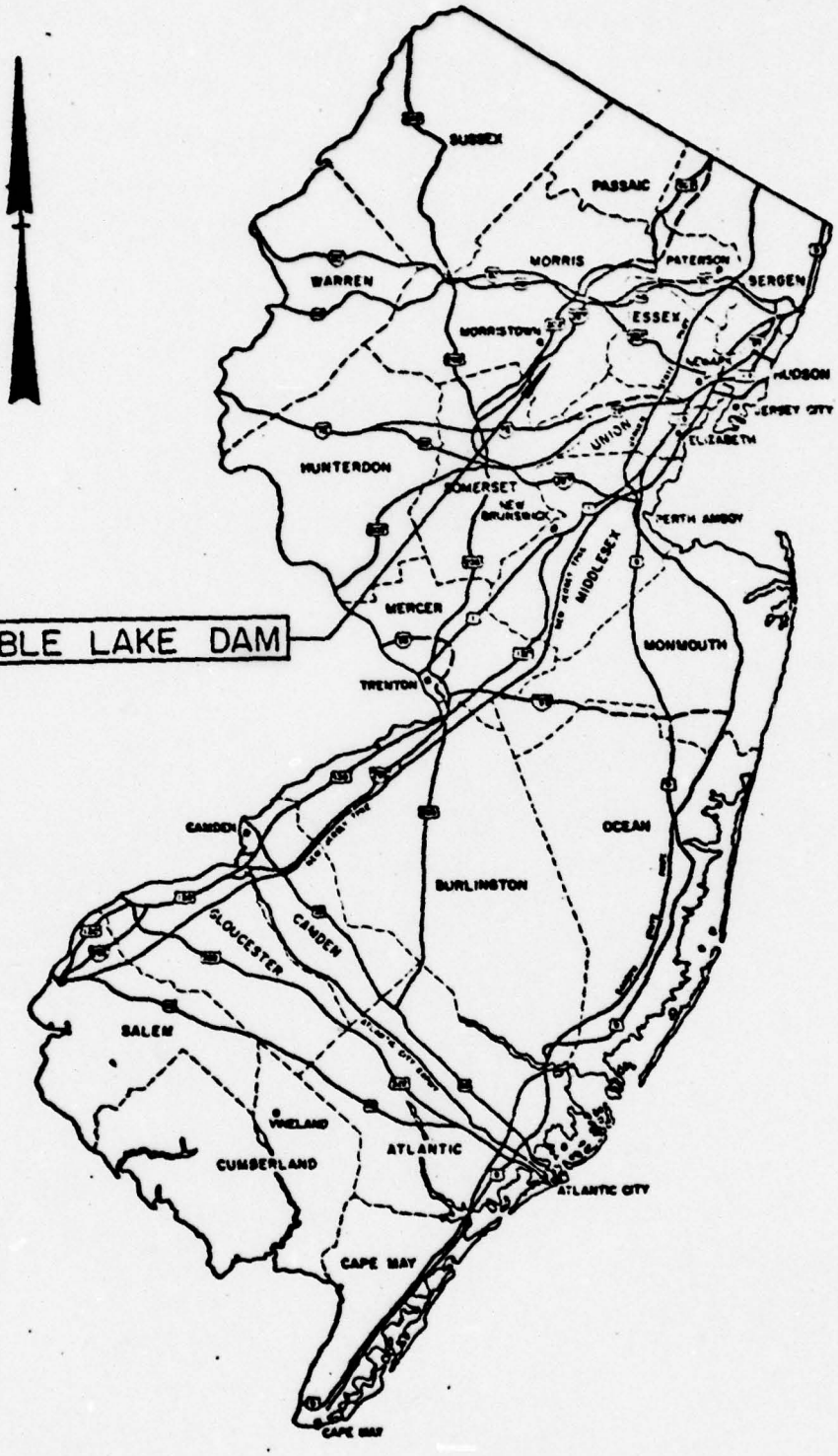
c. Additional Studies

A professional engineer experienced in the design and construction of dams should be engaged immediately to investigate the seepage observed on the downstream slope of dam. The investigation should include all necessary measures, such as: dye testing,

borings and measurements with piezometers, to determine the effect of the seepage on the structural integrity of the dam.

A detailed topographic survey of the dam and area around the dam based on USGS datum should be undertaken by a qualified licensed land surveyor or professional engineer in the near future. The survey map should be related to existing construction drawings and should become part of the permanent record mentioned in paragraph 7.2.b.

PLATES



MOUNT KEMBLE LAKE DAM

PLATE I

STORCH ENGINEERS FLORHAM PARK, NEW JERSEY	INSPECTION AND EVALUATION OF DAMS KEY MAP MOUNT KEMBLE LAKE DAM
DIVISION OF WATER RESOURCES N.J. DEPT. OF ENVIR. PROTECTION TRENTON, NEW JERSEY	I.D. N.J. 00363 — SCALE: NONE DATE: JUNE, 1979

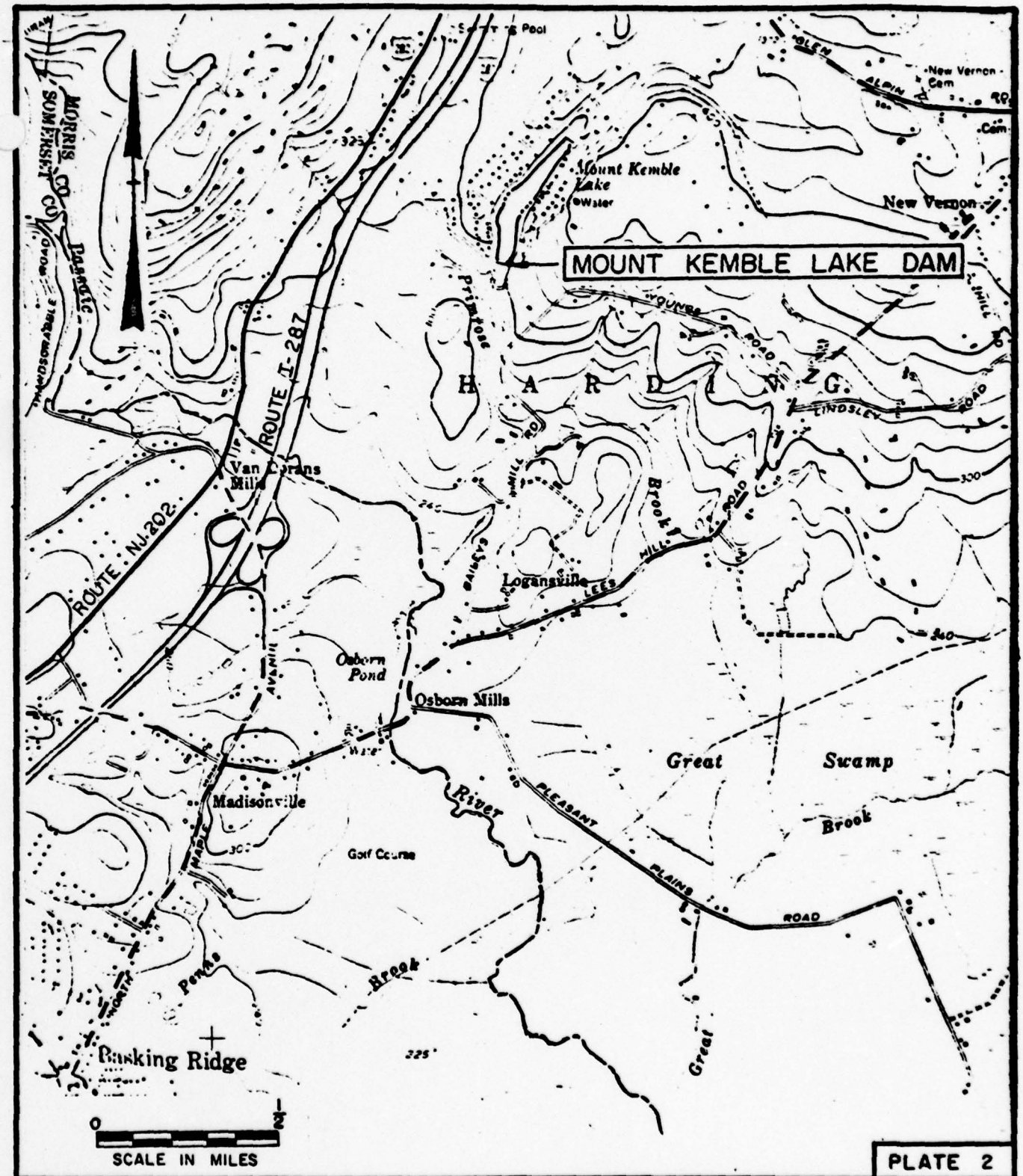


PLATE 2

STORCH ENGINEERS
FLORHAM PARK, NEW JERSEY

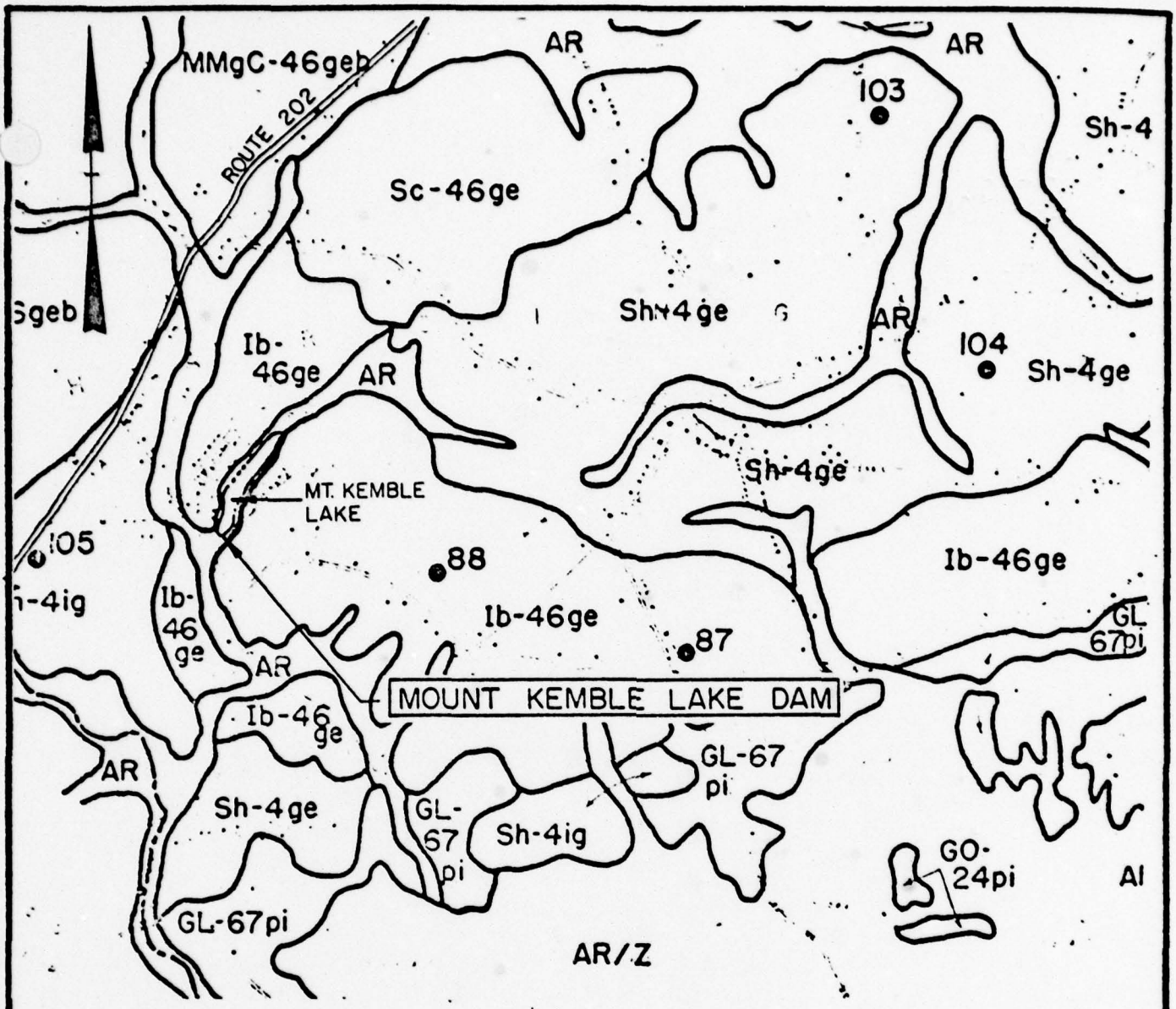
DIVISION OF WATER RESOURCES
N.J. DEPT. OF ENVIR. PROTECTION
TRENTON, NEW JERSEY

INSPECTION AND EVALUATION OF DAMS

VICINITY MAP

MOUNT KEMBLE LAKE DAM

I.D. NJ 00363	SCALE: AS SHOWN
	DATE: JUNE, 1979



Legend

AR	Recent alluvium composed of stratified materials deposited by streams.
Ib-46	Heavy textured colluvium and residual soil overlying basalt bedrock.

Note: Information taken from Rutgers University Soil Survey of New Jersey, Report No. 9, Morris County, and Geologic Map of New Jersey prepared by Lewis and Kummel.

PLATE 3

STORCH ENGINEERS
FLORHAM PARK, NEW JERSEY

DIVISION OF WATER RESOURCES
N.J. DEPT. OF ENVIR. PROTECTION
TRENTON, NEW JERSEY

INSPECTION AND EVALUATION OF DAMS

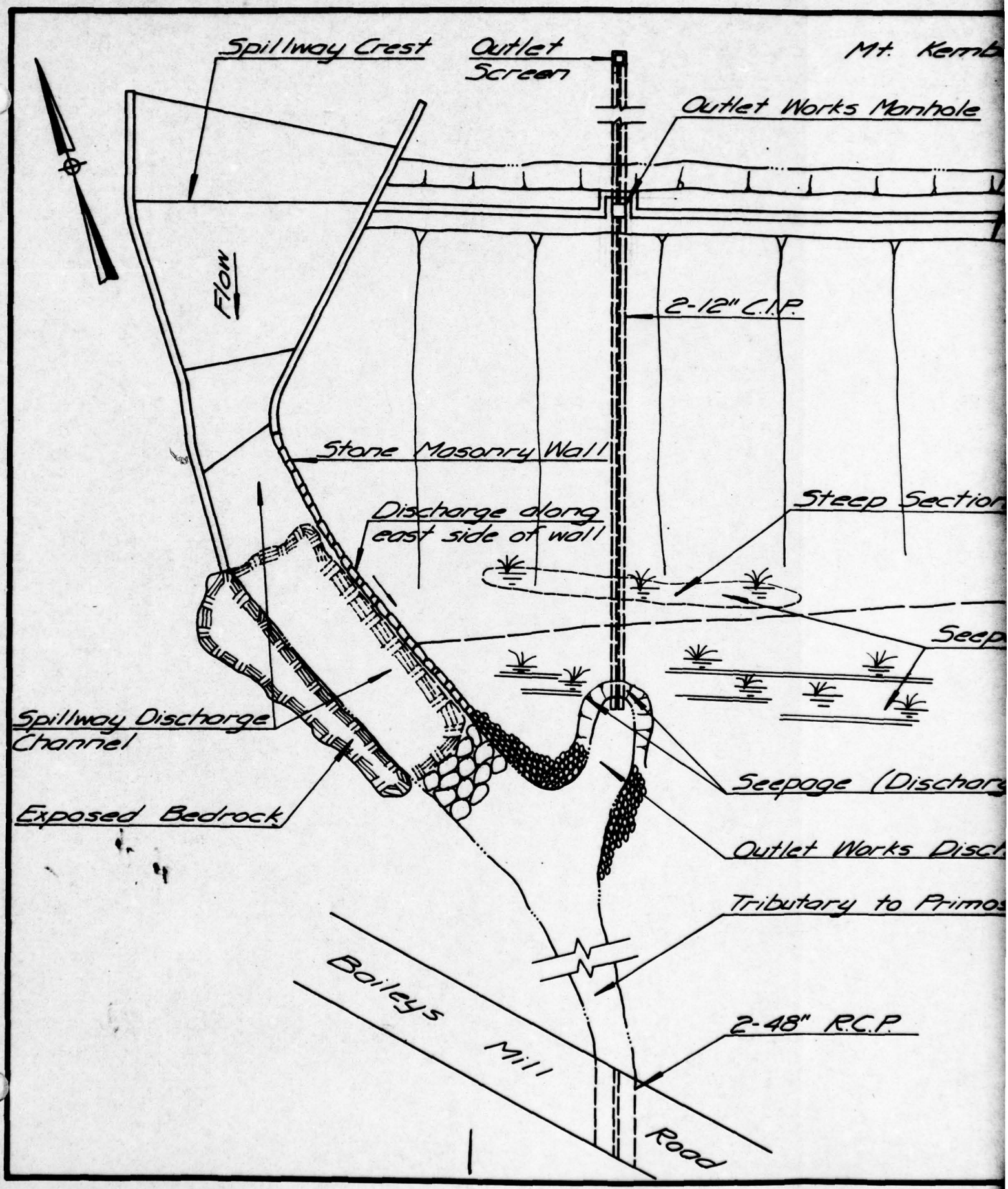
SOIL MAP

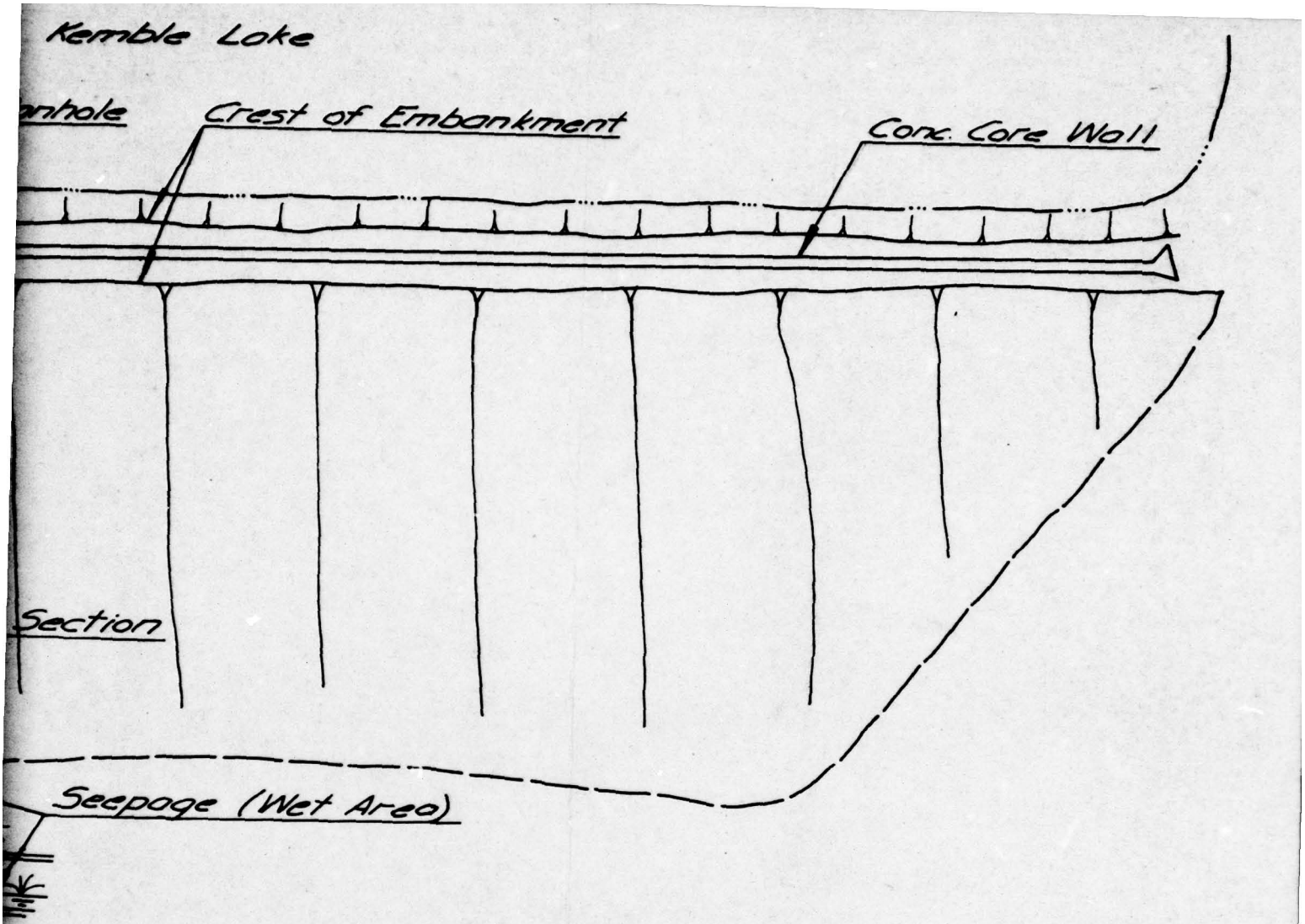
MOUNT KEMBLE LAKE DAM

I.D. NJ 00363

SCALE: NONE

DATE: JUNE, 1979


Spillway Crest
Outlet Screen
Mt. Kemb
Outlet Works Manhole
Flow
2-12" C.I.P.
Stone Masonry Wall
Discharge along east side of wall
Steep Section
Seep
Spillway Discharge Channel
Exposed Bedrock
Seepage (Discharg
Outlet Works Disch
Tributary to Primos
Baileys Mill
2-48" R.C.P.
Road



Note: Information taken from plans by Osborne M. Campbell dated February 1979 and field inspection April 24, 1979.

PLATE 4

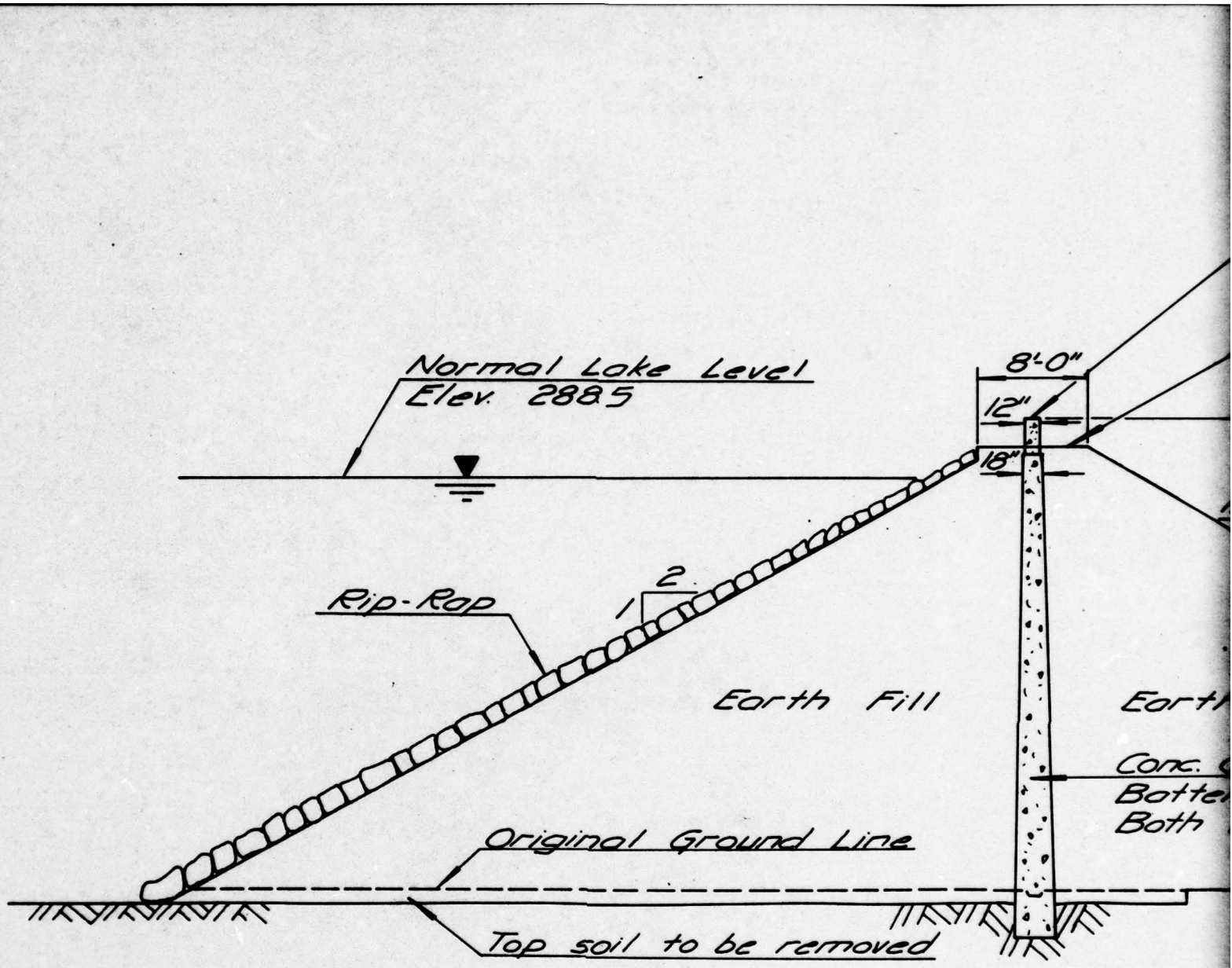
STORCH ENGINEERS FLORHAM PARK, NEW JERSEY	DIVISION OF WATER RESOURCES N.J. DEPT. OF ENVIR. PROTECTION TRENTON, NEW JERSEY

INSPECTION AND EVALUATION OF DAMS

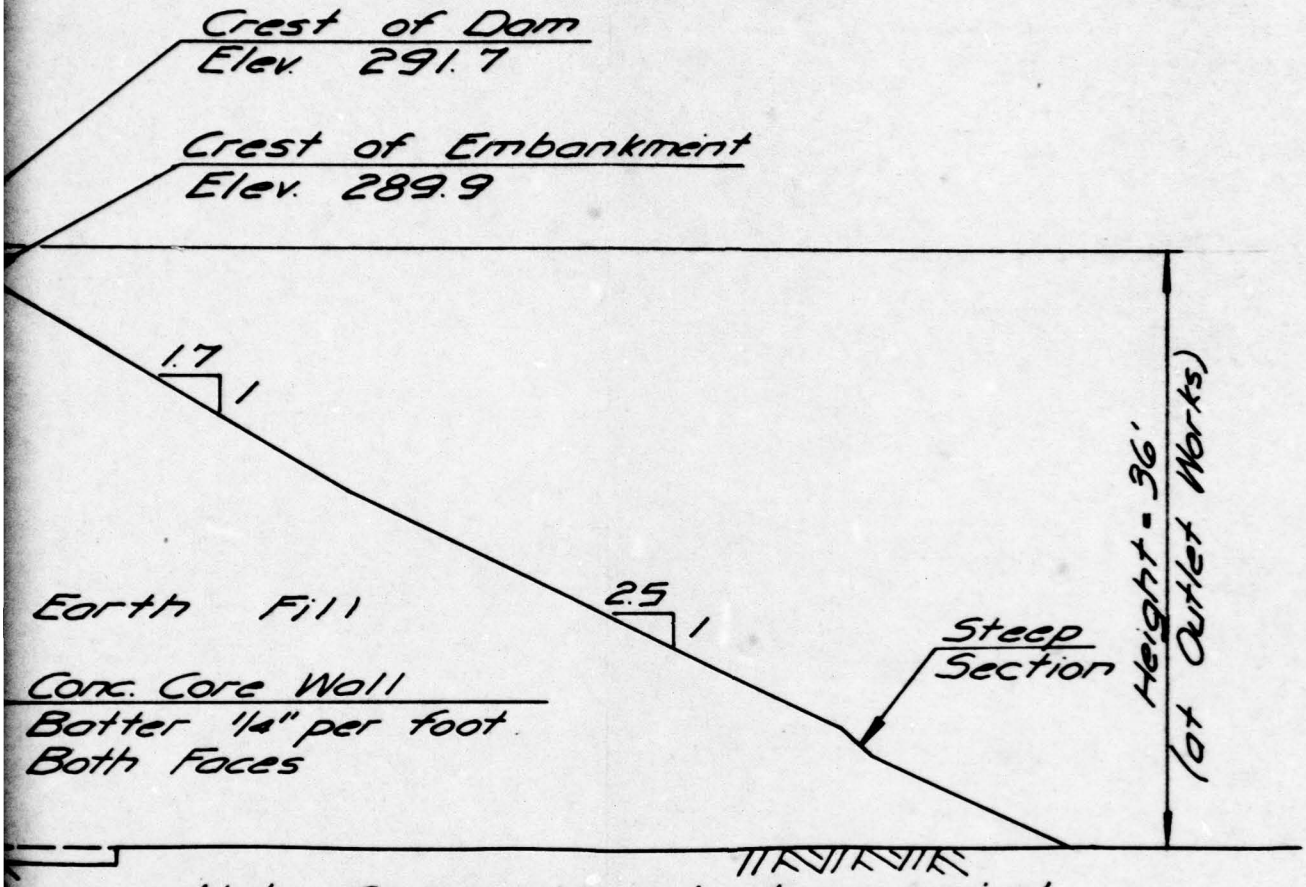
GENERAL PLAN

MT. KEMBLE LAKE DAM

I.D. NJ00363	SCALE: NOT TO SCALE
	DATE: JUNE, 1979



Note: Information taken from plans by W.H. Boardman dated Oct. 26, 1925, plans by Osborne M. Campbell dated Feb. 1975 and field inspection April 24, 1979.



Note: Core wall is to be carried down to ledge rock or into impervious soil stratum.

2

PLATE 5

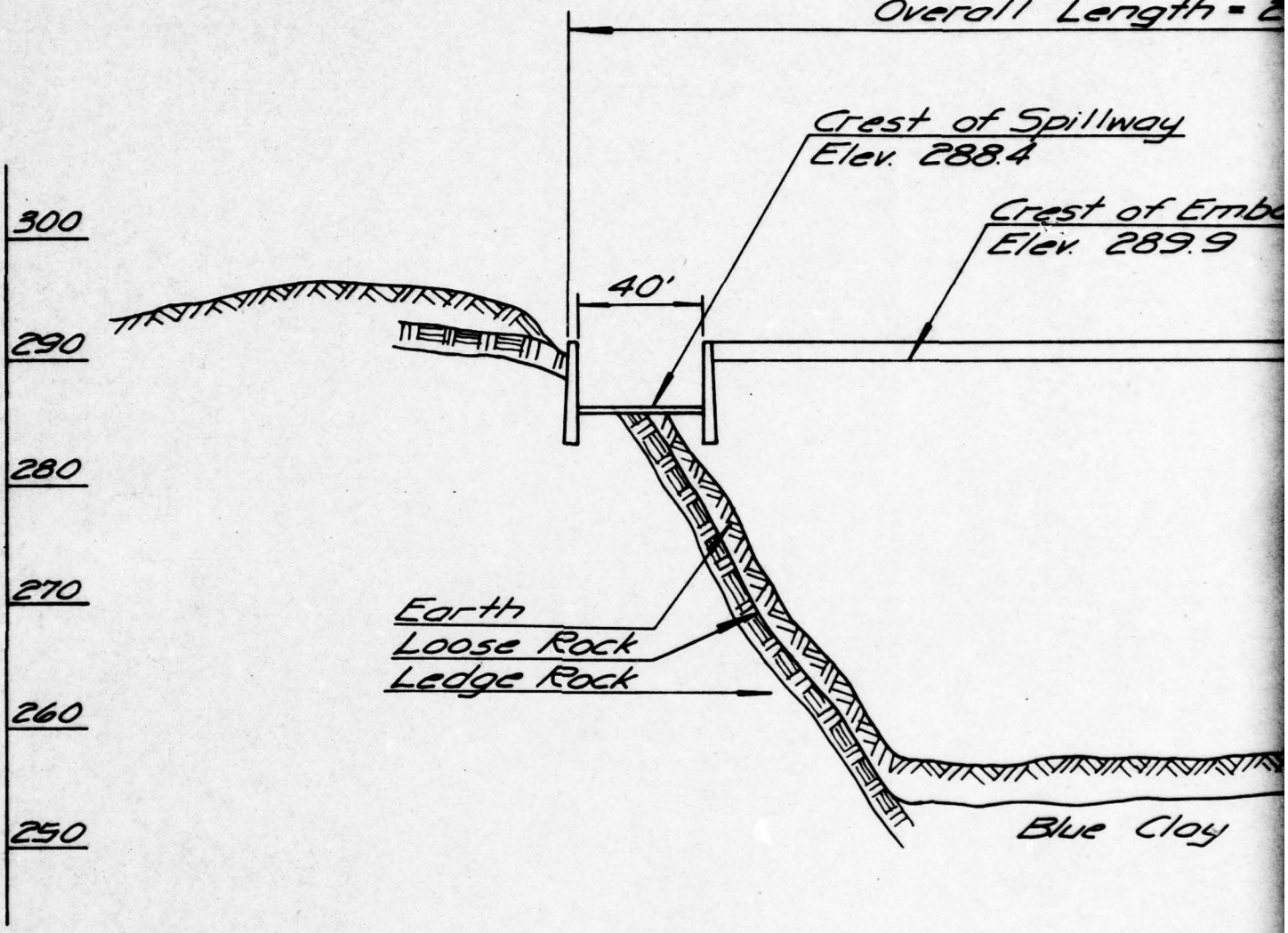
STORCH ENGINEERS FLORHAM PARK, NEW JERSEY	DIVISION OF WATER RESOURCES N.J. DEPT. OF ENVIR. PROTECTION TRENTON, NEW JERSEY

INSPECTION AND EVALUATION OF DAMS

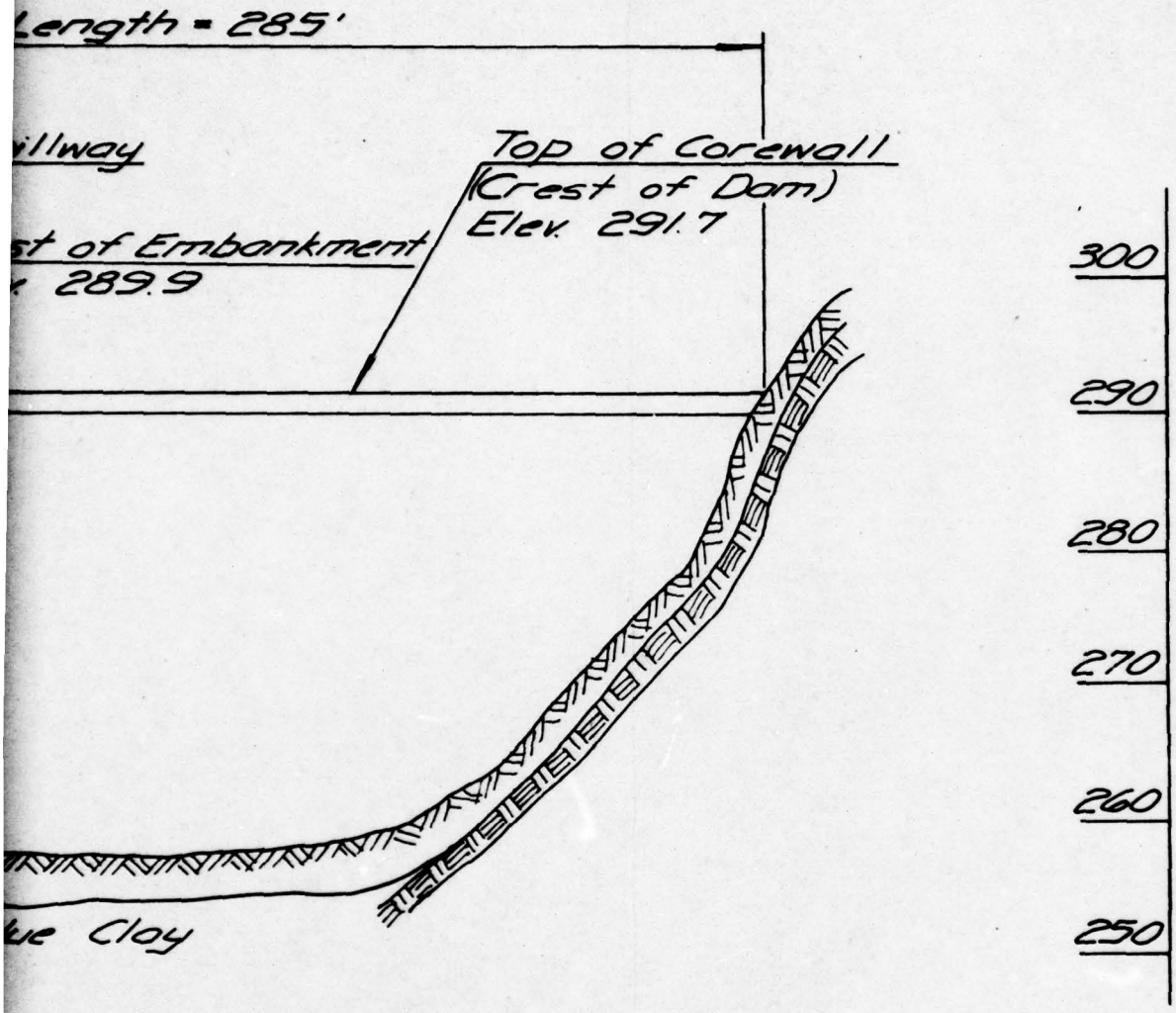
DAM SECTION

MT. KEMBLE LAKE DAM

I.D. N.J. 00363	SCALE: NOT TO SCALE
	DATE: JUNE, 1979



Note: Information taken from plans by W.H. Boardman dated Oct. 26, 1925, plans by Osborne M. Campbell dated Feb. 1975 and field inspection April 24, 1979.



2

PLATE 6

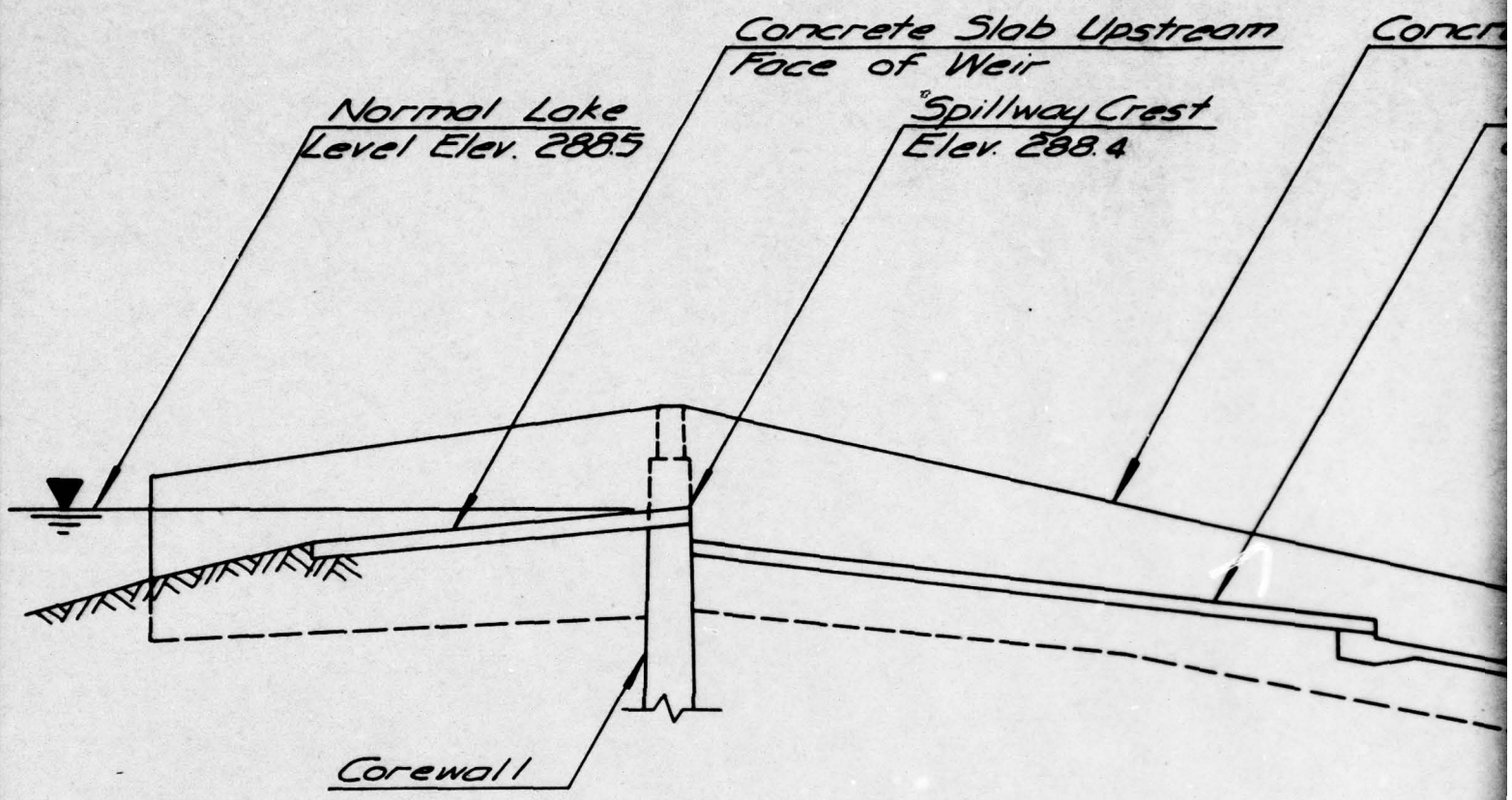
STORCH ENGINEERS FLORHAM PARK, NEW JERSEY	DIVISION OF WATER RESOURCES N.J. DEPT. OF ENVIR. PROTECTION TRENTON, NEW JERSEY

INSPECTION AND EVALUATION OF DAMS

DAM PROFILE

MT. KEMBLE LAKE DAM

I.D. N.J. 00363	SCALE: NOT TO SCALE
	DATE: JUNE, 1979



Note: Information taken from plans by Osborne M. Campbell dated Feb 1975 and field inspection April 24, 1979.

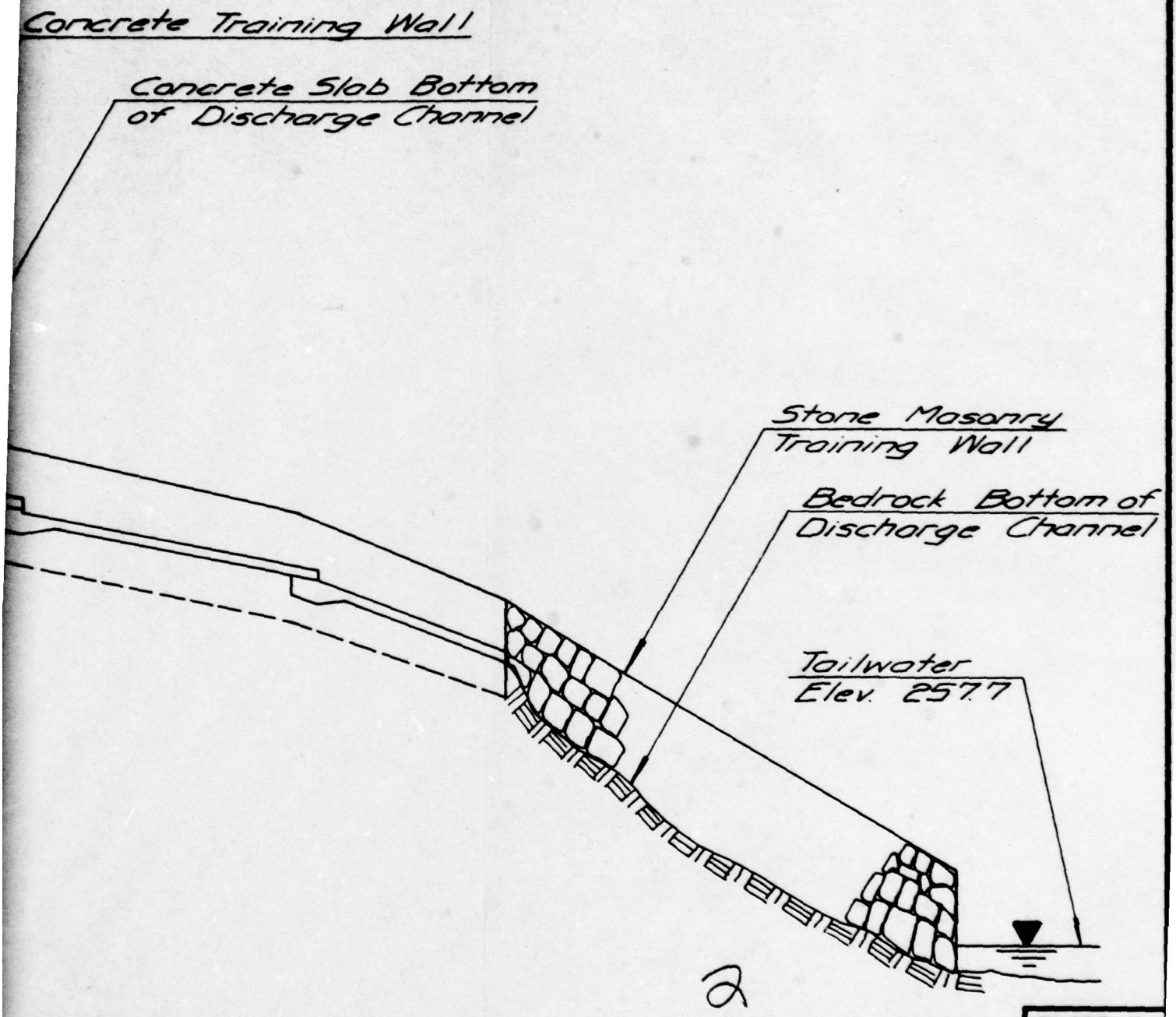


PLATE 7

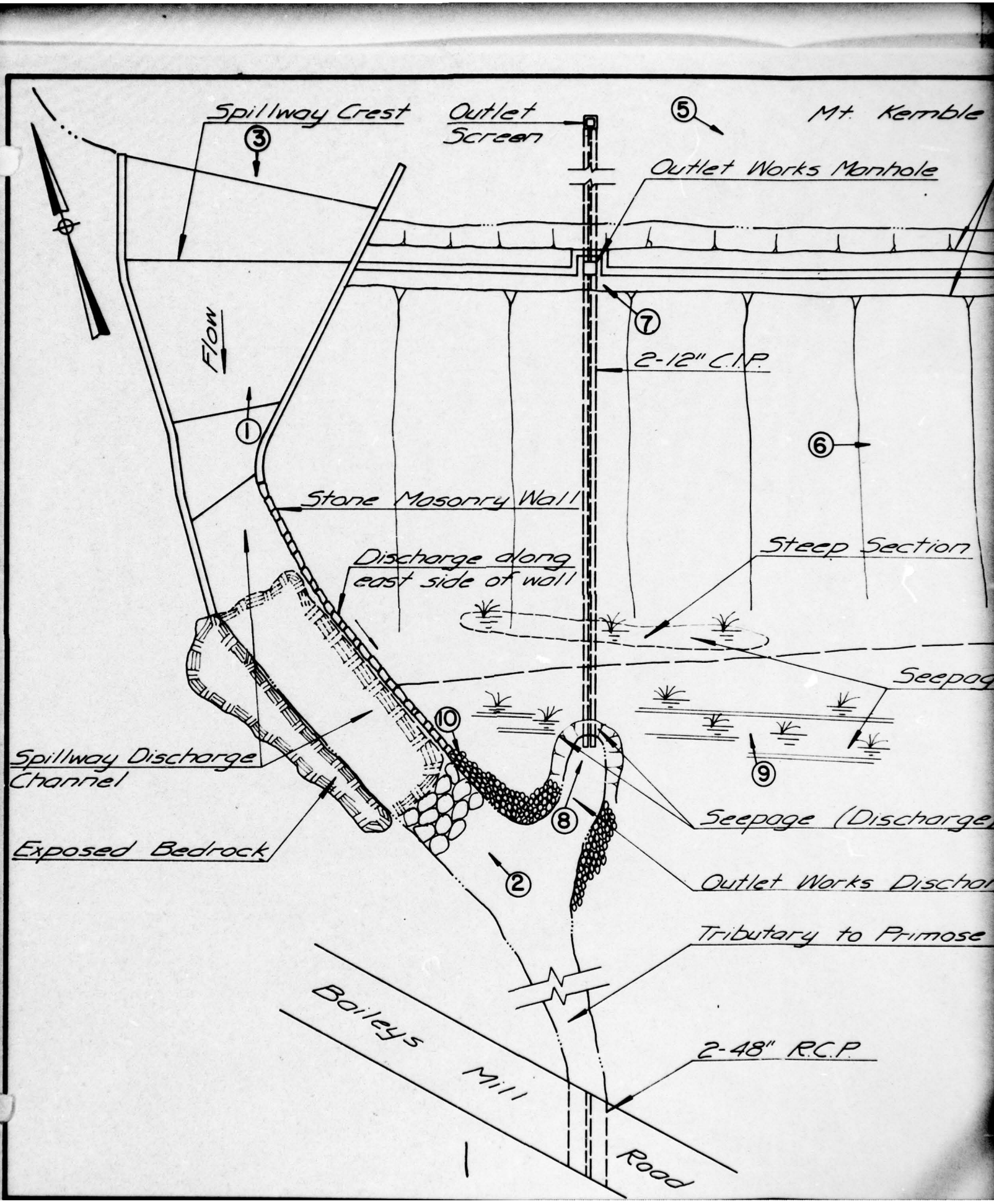
STORCH ENGINEERS FLORHAM PARK, NEW JERSEY	DIVISION OF WATER RESOURCES N.J. DEPT. OF ENVIR. PROTECTION TRENTON, NEW JERSEY

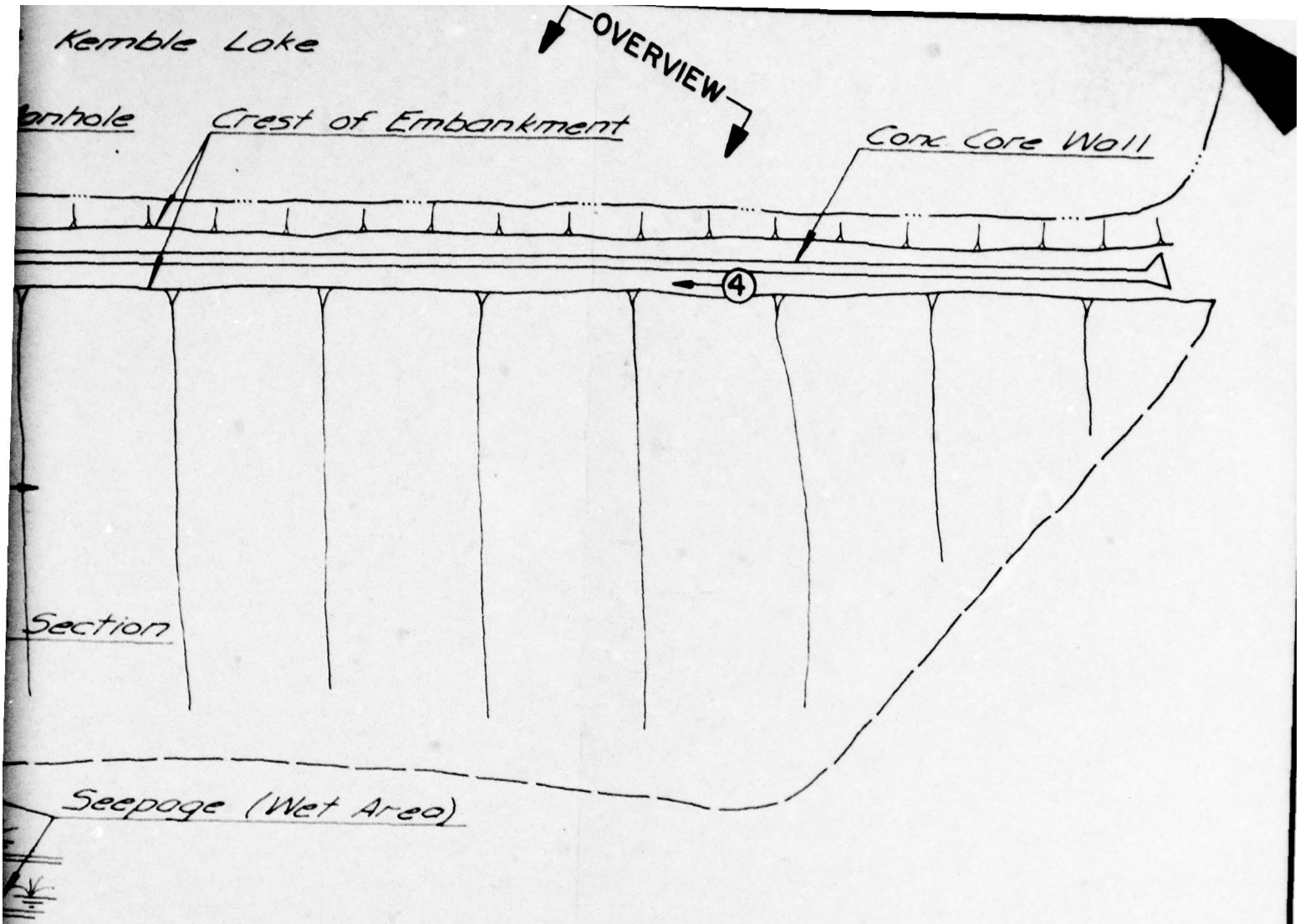
INSPECTION AND EVALUATION OF DAMS

SPILLWAY PROFILE

MT. KEMBLE LAKE DAM

I.D. N.J. 00363	SCALE: NOT TO SCALE
	DATE: JUNE, 1979


Spillway Crest
3
Outlet Screen
5
Mt. Kemble
Outlet Works Manhole
Flow
7
2-12" C.I.P.
1
6
Stone Masonry Wall
Discharge along east side of wall
Steep Section
Seepag
10
Spillway Discharge Channel
9
8
Seepage (Discharge
Exposed Bedrock
2
Outlet Works Dischar
Tributary to Primose
Baileys Mill
2-48" R.C.P
Road



Note Information taken from plans by Osborne M Campbell dated February 1975 and field inspection April 24, 1979

PLATE 8

STORCH ENGINEERS FLORHAM PARK, NEW JERSEY	DIVISION OF WATER RESOURCES N.J. DEPT. OF ENVIR. PROTECTION TRENTON, NEW JERSEY

INSPECTION AND EVALUATION OF DAMS

PHOTO LOCATION PLAN

MT. KEMBLE LAKE DAM

I.D. NJ00363	SCALE: NOT TO SCALE
	DATE: JUNE, 1979

APPENDIX 1

Check List - Visual Inspection

Check List - Engineering Data

Check List
Visual Inspection
Phase I

Name of Dam Mt. Kemble Lake County Morris State New Jersey Coordinators NJDEP

Date(s) Inspection 4/24/79
6/01/79 Weather Fair Temperature 70°F

Pool Elevation at Time of Inspection 288.5 M.S.L. Tailwater at Time of Inspection 257.7 M.S.L.

Inspection Personnel:

John Gribbin David Hoyt

Ronald Lai Joseph Fox

Richard McDermott

John Gribbin Recorder

Present (6/1/79): Richard Lynch, former president, Lakeshore Co.

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
GENERAL	N.A.	
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	N.A.	
DRAINS	N.A.	
WATER PASSAGES	N.A.	
FOUNDATION	N.A.	
VERTICAL AND HORIZONTAL ALIGNMENT	N.A.	

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	N.A.	
STRUCTURAL CRACKING	N.A.	
CONSTRUCTION JOINTS	N.A.	
MONOLITH JOINTS	N.A.	
LEAKAGE	N.A.	
SEEPAGE	N.A.	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
GENERAL	Embankment heavily wooded with pine and hardwood trees. Surface composed of typical forest litter. Concrete wall along crest of dam in generally good condition with vertical hairline cracks spaced each 15' to 20' apart.	Some pine trees on downstream slope had been planted as slope protection.
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Junctions at abutments and at spillway wingwall appear to be in satisfactory condition.	
ANY NOTICEABLE SEEPAGE	Seepage observed at several locations. Large wet area along west half of toe of dam. Two zones of seepage in bank above discharge end of outlet works pipe; one zone with orange deposits. Both seepage zones discharging as trickles.	
	Flow observed along stone wall that forms east side of spillway discharge channel. Flow is on east side of wall (outside channel) and has magnitude approx. 0.5 c.f.s. (6/1/79)	It cannot be determined whether flow is seepage or leakage from spillway discharge channel.
DRAINS	None	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None observed.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None observed.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	A steep section of the downstream slope in the vicinity of the outlet works discharge approx. 5' above the toe indicates the possibility of some embankment sloughing. The steep section has a vertical extent of approx. 4' and is wet.	Runoff from road east of the dam appears to be directed so that it flows along the east junction between abutment and downstream face of dam.
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Vertical: Level Horizontal: generally straight with slight bend. Downstream face varies in slope from 1.7:1 at the top to 2.6:1 at the toe. Also, a steep section is present near the toe in the vicinity of the outlet works discharge.	Original construction drawings indicate that slope is 2:1.
RIPRAP FAILURES	Riprap on upstream face at eastern end of dam in good condition. Riprap present along entire upstream face below water line. Riprap absent or sparce above water line in center and western portions of embankment.	

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SURFACES IN OUTLET CONDUIT	N.A.	
INTAKE STRUCTURE	Submerged.	
OUTLET STRUCTURE	Discharge end of pipe submerged in discharge channel.	
OUTLET CHANNEL	Narrow, well defined natural channel that joins spillway downstream channel approx. 30' downstream from outlet works discharge.	
GATE AND GATE HOUSING	The gate operating stems and the lid and steps of the outlet works manhole are rusted but in generally good condition. Concrete surfaces of the manhole are generally in good condition. Vertical cracks with widths of 1/8" each are present in the east and west walls of the manhole.	

SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Crest is generally level for eastern two-thirds and increases in elevation toward west end. Crest is in two sections; western section is deteriorated and has been patched. The eastern section is in satisfactory condition.	
APPROACH CHANNEL	N.A.	
DISCHARGE CHANNEL	Steep channel with stepped concrete bottom and concrete training walls on both sides. Concrete bottom is deteriorated on west side. The eastern side is in generally satisfactory condition with one large cavity or spall.	Lower end of discharge channel consists of free flow over exposed bedrock. East training wall is stone masonry wall with discharge flowing along its east side.
WINGWALLS	West wingwall is in good condition. East wingwall has three vertical cracks near the point of intersection of the wingwall and the wall on the dam crest. There is one crack in each of the three branches of the intersection.	These cracks could be an indication of settlement of the spillway crest.

INSTRUMENTATION

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None	
OBSERVATION WELLS	None	
WEIRS	None	
PIEZOMETERS	None	
OTHER	N.A.	

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Slopes along lake are approx. 25%.	
SEDIMENTATION	Unknown	
STRUCTURES ALONG BANKS	Lake is surrounded by dwellings located generally greater than 20' above normal lake stage. Many homesites include docks and other lake related structures at the shoreline.	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Well defined natural stream with cobbled bottom. Rocks and minor debris comprise a slight obstruction to flow.	
SLOPES	Stream has steep banks approx. 3' high on both sides.	
STRUCTURES ALONG BANKS	Secondary road approx. 250' downstream from dam. One dwelling approx. 2100' downstream from dam; first floor 10.5' above stream bottom.	

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS
DAM - PLAN	Plan titled "Plan and Sections for the Mt. Kemble Lake Dam" prepared by W. H. Boardman, dated Oct. 7, 1925, revised Oct. 26, 1925.
SECTIONS	
SPILLWAY - PLAN	Drawings titled "Mt. Kemble Lake Dam" prepared by Osborne M. Campbell & Associates, dated February 1975.
SECTIONS	
DETAILS	
OPERATING EQUIPMENT PLANS & DETAILS	Not available
OUTLETS - PLAN	Available (limited) Boardman plans, Campbell plans
DETAILS	
CONSTRAINTS	Not available
DISCHARGE RATINGS	Not available
HYDRAULIC/HYDROLOGIC DATA	Available but limited (NJDEP file)
RAINFALL/RESERVOIR RECORDS	Available but limited (NJDEP file)
CONSTRUCTION HISTORY	Available in NJDEP file
LOCATION MAP	Not available

ITEM	REMARKS
DESIGN REPORTS	Engineers Report by Osborne M. Campbell available in NJDEP file
GEOLOGY REPORTS	Not available
DESIGN COMPUTATIONS	
HYDROLOGY & HYDRAULICS	Available in NJDEP file
DAM STABILITY	Not available
SEEPAGE STUDIES	Not available
MATERIALS INVESTIGATIONS	Not available
BORING RECORDS	
LABORATORY	
FIELD	
POST-CONSTRUCTION SURVEYS OF DAM	Not available
BORROW SOURCES	Not available

ITEM	REMARKS
MONITORING SYSTEMS	Not Available
MODIFICATIONS	Campbell plans
HIGH POOL RECORDS	Not Available
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	Not Available
PRIOR ACCIDENTS OR FAILURE OF DAM	Partial washout in 1971
DESCRIPTION	Available in NJDEP file
REPORTS	Not Available
MAINTENANCE	Not Available
OPERATION RECORDS	One drawdown permit in NJDEP file

APPENDIX 2

Photographs

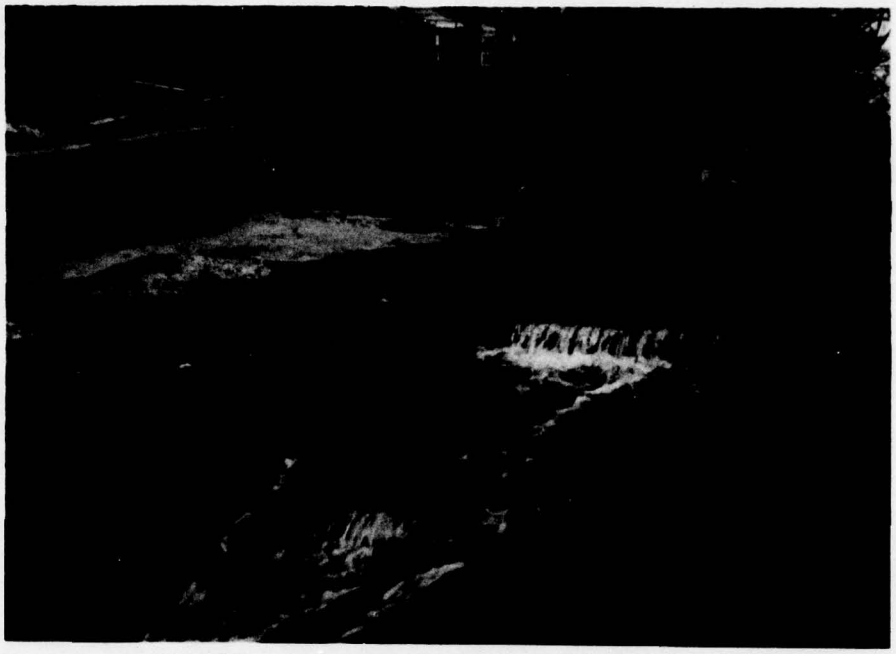


PHOTO 1

SPILLWAY

PHOTO 2

SPILLWAY OUTLET

MOUNT KEMBLE LAKE DAM
24 APRIL 1979

PHOTO 3

UPSTREAM VIEW OF SPILLWAY

PHOTO 4

CREST OF DAM

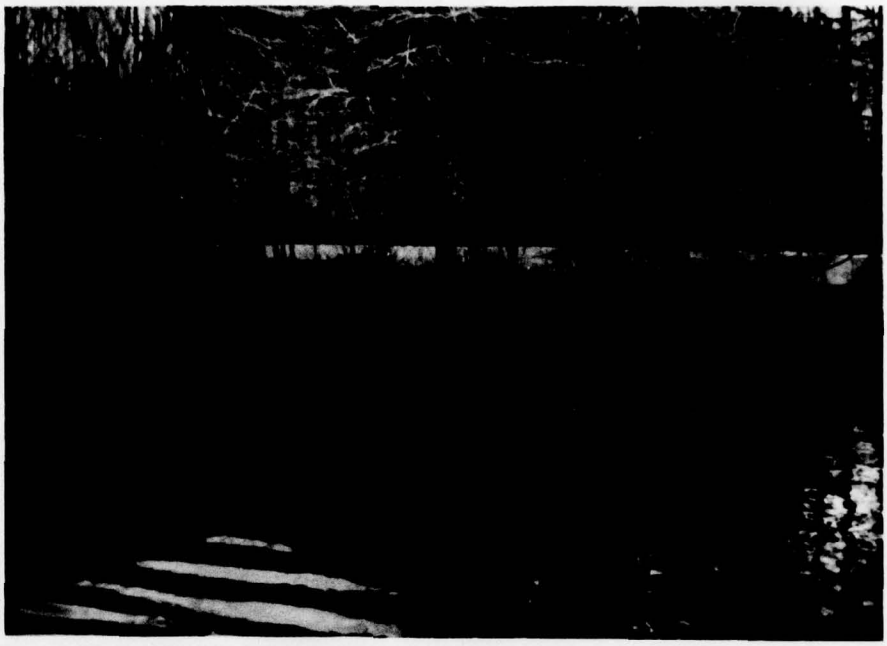


PHOTO 5

UPSTREAM FACE OF DAM

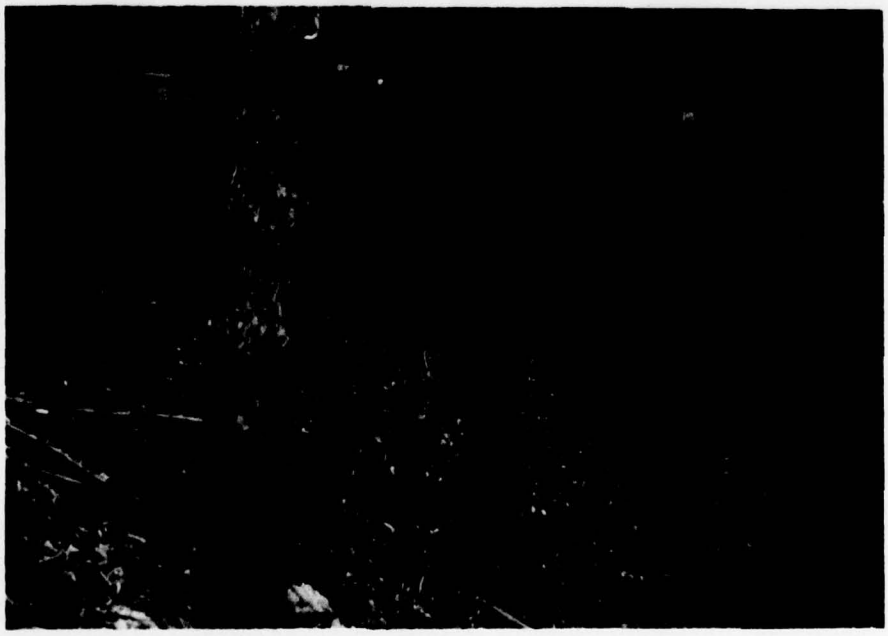


PHOTO 6

DOWNSTREAM FACE OF DAM

MOUNT KEMBLE LAKE DAM
24 APRIL 1979

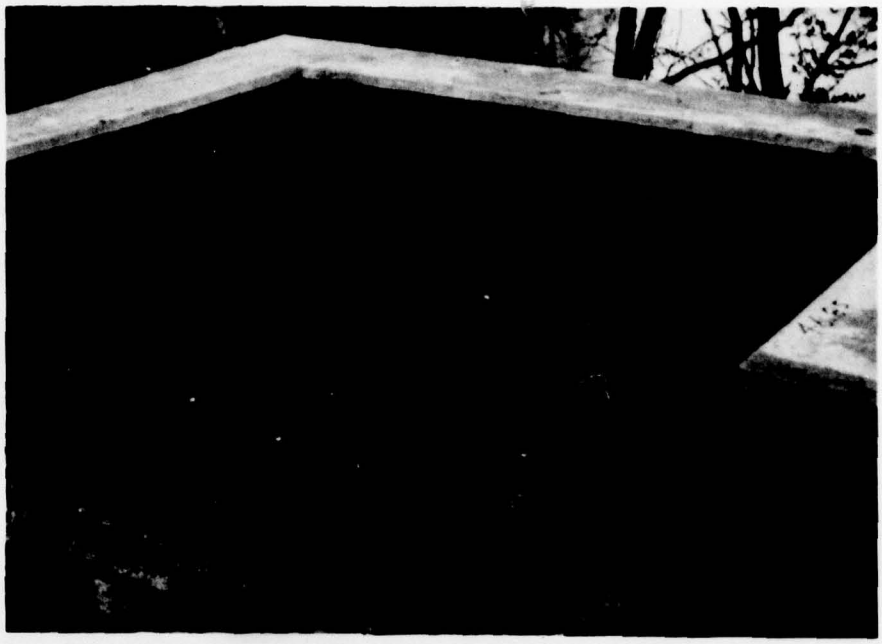


PHOTO 7

OUTLET WORKS OPERATING MECHANISM

PHOTO 8

OUTLET WORKS DISCHARGE PIPE (SUBMERGED).
SEEPAGE ABOVE PIPE.

MOUNT KEMBLE LAKE DAM
24 APRIL 1979

PHOTO 9

SEEPAGE AT TOE OF DAM

PHOTO 10

DOWNSTREAM CHANNEL

MOUNT KEMBLE LAKE DAM
24 APRIL 1979

CHECK LIST

HYDROLOGIC AND HYDRAULIC DATA

ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: Mostly wooded and hilly

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 288.5 (118 acre-feet)

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): N.A.

ELEVATION MAXIMUM DESIGN POOL: 291.7

ELEVATION TOP DAM: 291.7

SPILLWAY CREST: Concrete Weir

a. Elevation 288.4
b. Type Chute
c. Width 10 feet
d. Length 40 feet
e. Location Spillover Along centerline of dam
f. Number and Type of Gates None

OUTLET WORKS: Gated Pipes

a. Type Twin cast iron pipes with gates
b. Location 35 feet east of spillway
c. Entrance inverts unknown
d. Exit inverts 255.7
e. Emergency draindown facilities: Open gates

HYDROMETEOROLOGICAL GAGES: None

a. Type N.A.
b. Location N.A.
c. Records N.A.

MAXIMUM NON-DAMAGING DISCHARGE:

(Lake stage equal to top of dam) 610 c.f.s.

APPENDIX 4

Hydrologic Computations

STORCH ENGINEERS

Sheet 1 of 8

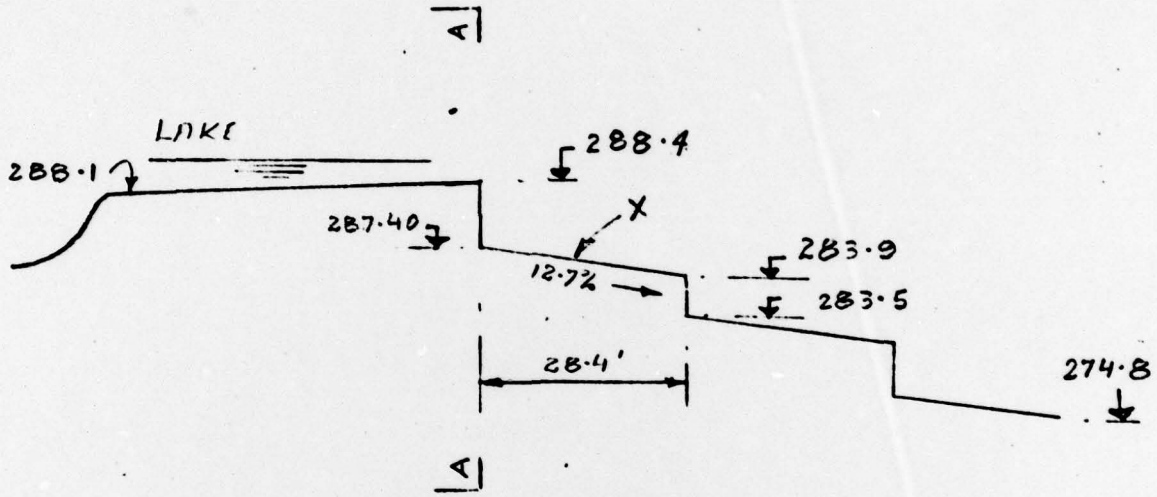
Project S.E. # 11336 MT. KEMBLE DAM — Made By DMP Date 6/12/79

HYDRAULICS — Chkd By RL Date 6-?-79

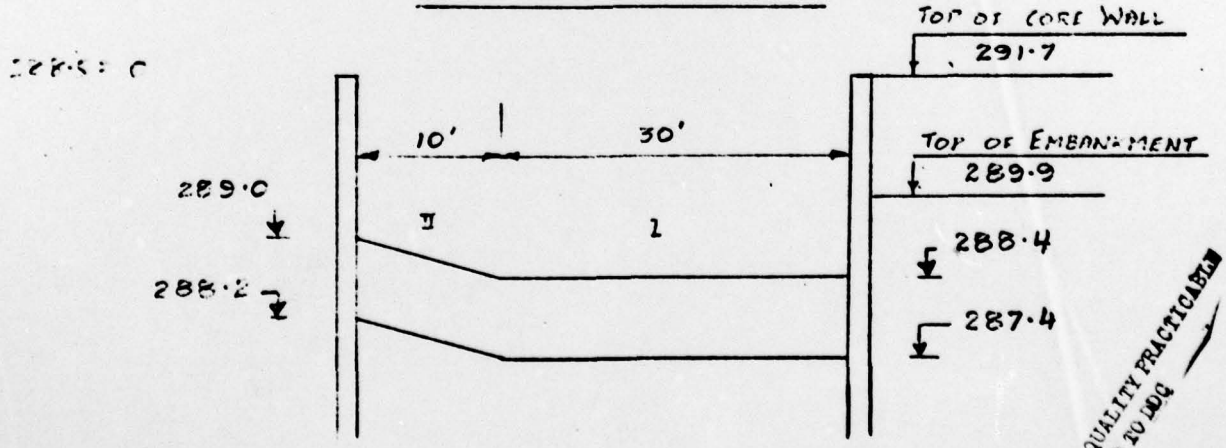
MT. KEMBLE DAM

HYDRAULICS

PRINCIPAL SPILLWAY



LONGITUDINAL SECTION



SECTION AA

For the purpose of calculating stage-discharge relationship, the spillway will be divided into two sections.

The flow over sections I & II will be calculated using the following formula :-

$$Q = CLH^{3/2}.$$

where Q = Discharge in CFS

C = Discharge coefficient. In this case it will be taken as 2.63.
(Page 5.23. King & Brater, Handbook of Hydraulics.

L = effective length of crest.

H = Total head on the crest.

For calculating flow in Section II, the total head will be taken as an average over the width of 10 ft.

STORCH ENGINEERS

Sheet 3 of 8

Project S.E. # 1132 B MT KEMBLE DAM

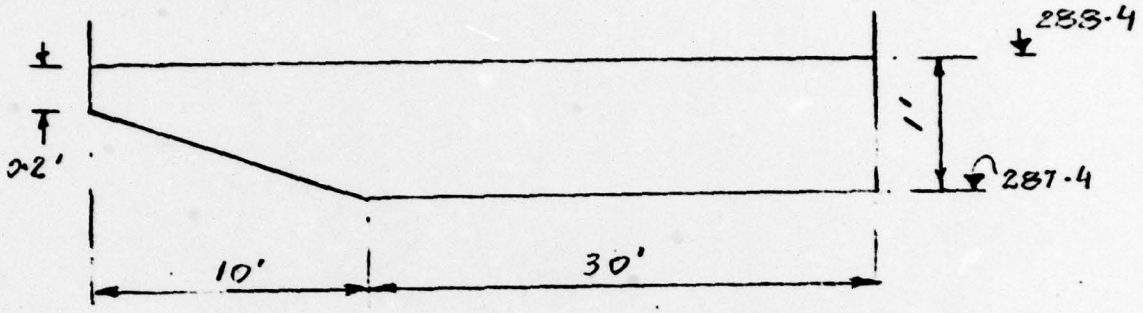
Made By DMF Date 6/12/79

HYDRAULICS

Chkd By RL Date 6-12-79

Elevation	H_1 (Ft)	$Q_1 = (2.63)(30)H_1^{3/2}$ (CFS)	H_2 (Ft)	$Q_2 = (2.63)(10)H_2^{3/2}$ (CFS)	TOTAL Q(CFS) (Q_1+Q_2)	
288.4	0	0	0	0	0	
289.0	0.6	37	0.3	4	41	
289.5	1.1	91	0.8	19	110	
290.0	1.6	160	1.3	39	199	
290.5	2.1	240	1.8	64	304	
291.0	2.6	331	2.3	92	423	
291.5	3.1	431	2.8	123	554	
291.7	3.3	473	3.0	137	610	CREST OF DAM

DETERMINATION OF THE EFFECT OF TAILWATER



The discharge for water stage of 288.4 in section X of the spillway will be calculated by Manning's Formula:

$$Q = A \cdot \frac{1.486}{n} R^{2/3} S^{1/2}$$

Area $A = 30 \times 1 + 0.2 \times 10 + \frac{1}{2} \times 2 \times 8 \times 10$

$= 30 + 2 + 4 = 36 \text{ S.F.}$

Wetted Perimeter $W = 1 + 30 + 10 + 0.2 = 41.2 \text{ Ft}$

$S = 12.7\%$

$n = 0.014$

$$\therefore Q = (36)\left(\frac{1.486}{0.014}\right)\left(\frac{36}{41.2}\right)^{2/3}\left(\frac{12.7}{100}\right)^{1/2}$$

$= 1243 \text{ CFS}$

Since the above is nearly twice the flow over the spillway when the water stage in the lake is at the top of the embankment wall, there will not be any effect of the tailwater.

ITEM

DESIGN

GEOLOGY

DESIGN C
HYDROL
DAM ST
SEEPAG

MATERIAL
BORING
LABORA
FIELD

POST-CONS

BORROW SC

STORCH ENGINEERS

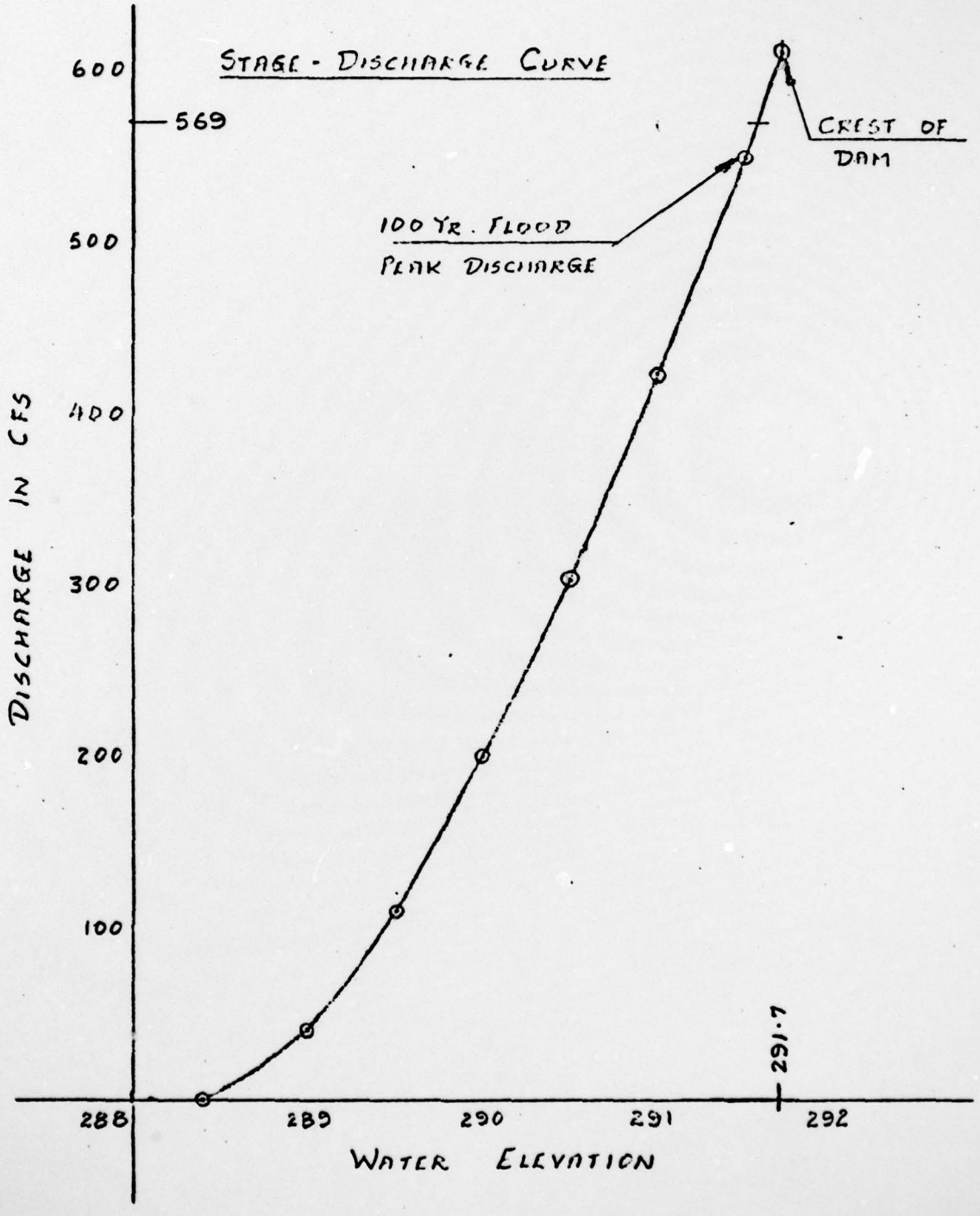
Sheet 5 of 8

Project S E # 1132 B MT KEMBLE DAM

Made By DMP Date 6-11-79

HYDRAULICS

Chkd By RL Date 6-18-79



Capacity of Outlet

Outlet 2 - 12" Dia CIP
Invert at outlet 261
Assume pipe to be level
Normal water elevation 288.5 use 289
Approx length of pipe 100 ft

Outlet control

$H = 27.5$ ft
$n = 0.012$
$L = 100$ ft
$Ke = 0.5$

$Q = 2 \times 16 = 32$ cfs at normal pool

Drawdown Calculation

Elev.	(Ac-ft) Storage	(Ac-ft) ΔStorage	(ft) H	(cfs) Q	(cfs) Avg Q	Ac-ft/day	Days
289	118		28	32			
		44			30	59.5	0.74
283	74		22	28			
		35			26	51.6	0.68
277	39		16	24			
		24			17	33.7	0.71
271	15		10	10			
		11			8	15.9	0.69
265	4		4	6			
		4			3	6.0	0.66
261	0		0	0			

3.48

= 3.5 days.

MT KEMBLE DAM

HYDROLOGY

The 100 year Flood Peak discharge will be calculated using the following formula from Special Report #38.

$$Q_{100} = 131\, A^{0.84}\, S^{0.26}\, S_t^{-0.51}\, I^{0.14}$$

1. Drainage Area $A = 0.73$ Sq. Mi.

2. Main channel Slope (S):-

Length of main-channel = 0.95 Mile

10% of stream length = 0.1 Mile

Elevation at 10% of stream length } = 310

85% of stream length = 0.81 Mile

Elevation at 85% of stream length } = 450

$$\therefore S = \frac{450 - 310}{0.81 - 0.10} = 197 \text{ Ft/Mi}$$

3 Surface Storage Index (S_t):-

For small drainage area, use $S_t = 1\%$

4 Manmade - Impervious Cover Index I

Estimated number of homes = 120

Population in drainage Area say 500

Population density = $\frac{500}{0.73}$ = 685 Persons/Sq Mi

Impervious cover index I = 10 %

5 100 year flood - peak discharge Q_{100} :-

$$Q_{100} = 136\, A^{0.84} S^{0.26} S_t^{-0.51} I^{0.14}$$

$$Q_{100} = 136\, (.73)^{.84} (197)^{.26} (1)^{-.51} (10)^{.14}$$

$$Q_{100} = 569 \text{ c.f.s.}$$

APPENDIX 5

Bibliography

1. "Recommended Guidelines for Safety Inspection of Dams," Department of the Army, Office of the Chief of Engineers, Washington, D.C. 20314.

2. Design of Small Dams, Second Edition, United States Department of the Interior, Bureau of Reclamation, United States Government Printing Office, Washington, 1973.

3. Holman, William W. and Jumikis, Alfreds R., Engineering Soil Survey of New Jersey, Report No. 9, Morris County, Rutgers University, New Brunswick, N.J. 1953.

4. "Geologic Map of New Jersey," prepared by J. Volney Lewis and Henry B. Kummel, dated 1910 - 1912.

5. Stankowski, Stephen J., Magnitude and Frequency of Floods in New Jersey with Effects of Urbanization, Special Report 38, State of New Jersey Department of Environmental Protection. Division of Water Resources, 1974.

6. Herr, Lester A., Hydraulic Charts for the Selection of Highway Culverts, U.S. Department of Transportation, Federal Highway Administration, 1965.

7. Safety of Small Dams, Proceedings of the Engineering Foundation Conference, American Society of Civil Engineers, 1974.

8. King, Horace Williams and Brater, Ernest F., Handbook of Hydraulics, Fifth Edition, McGraw-Hill Book Company, 1963.

9. Plan titled "Plan and Sections for the Mt. Kemble Lake Dam," prepared by W.H. Boardman, dated October 7, 1925, revised October 26, 1925.

10. Drawings titled "Mt. Kemble Lake Dam," prepared by Osborne M. Campbell & Associates, dated February 1975.